73 AMATEUR RADIO

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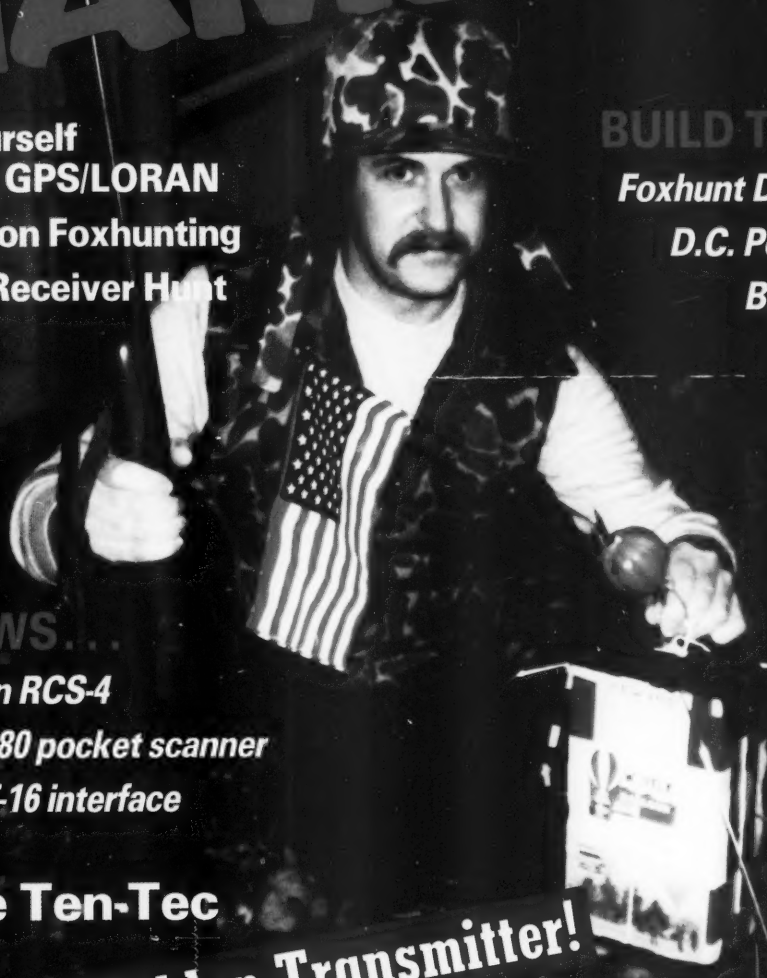
HAMBO!



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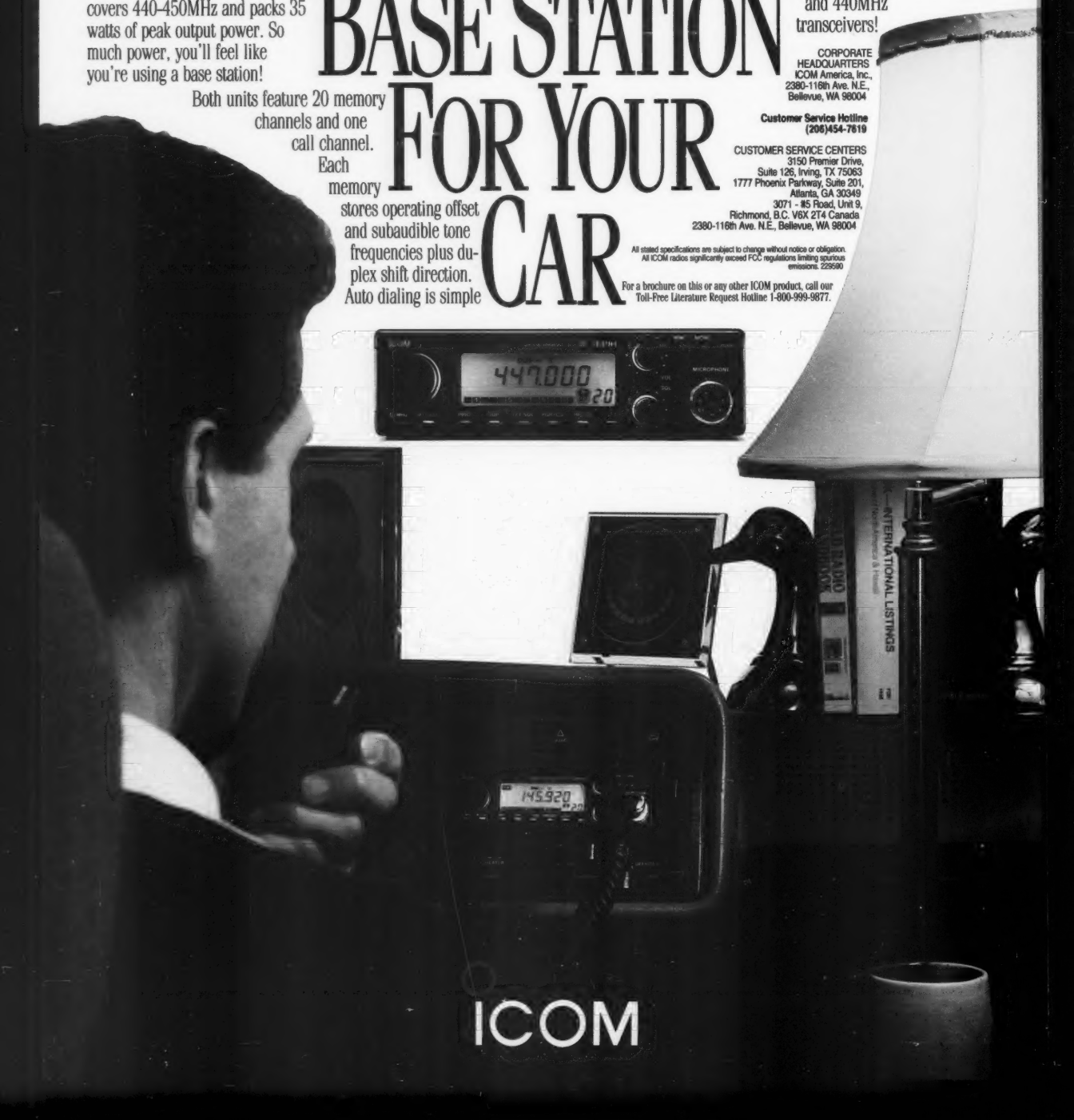

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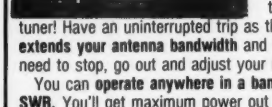
MFJ's *Mobile* Tuner

MFJ-945C **$89.95**



Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

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LETTERS

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From the Hamshack

KA1COJ: I haven't been very active lately—maybe 20 QSOs a year. I picked up your March *73* and read it through. Your column stuck in my mind, so I read it again a couple of times. Suddenly it all made sense to me. I ordered your 20 wpm Blitz Tape and the Tech, General and Advanced books from "Uncle Wayne's Book Shelf." The night the package arrived I plugged in your tape and followed your instructions. I spent about ten minutes a night with the tape. By the first week I'd gone from around 7 wpm to being able to copy W1AW almost solid at 13 per. By the second week I could copy the ARRL CW bulletin! Just 17 days after getting your tape I passed the 13 per General test with flying colors. It was the greatest feeling walking out of the exam with my temporary certificate. I'm a believer again! Thanks, Wayne.

Good work Arthur, now get all the rest of the Novices and Techs in your area going . . . Wayne

Griggs, Milford DE: I've read your recent ideas for attracting new hams and would like to add more fuel. The local ham clubs don't list their activities in the newspapers, nor in the telephone books. Through the help of WA3DPJ and his partner at A & A Electronics I was able to take my Novice test and pass. It would sure help if clubs would list activities in the newspapers and on school, ham store and Radio Shack bulletin boards. How about clubs renting out the extra ham gear which the members have available? If we paid for our licenses maybe the FCC wouldn't make us wait for six weeks for our licenses.

NH6EN: I share your fear that we will become a second rate nation in education and technology. We need to expose our kids to science, math and technology in a positive way. The Hamsats in the classrooms is an excellent idea. I'm involved with the Naval Sea Cadets (submarines), a new program I started. The kids love it. I'm getting ready to put on an amateur radio demonstration in the local school. I know it'll be a big hit. These kids really eat this stuff up! I find it very rewarding.

Good show Robert, but don't forget to take some pictures for me . . . Wayne

Guy Lemke, Redding CA: I don't see any effort around here by hams to attract newcomers. I know many people who would love to have a ham ticket but don't know where to start or where to get the support it takes to keep them motivated. It's a shame.

Okay, Redding hams, where are your club meeting notices in the papers? Where's your notice on the Radio Shack bulletin board? . . . Wayne

W2JTP/7: Ever since reading the March and April issues of *73* I have been trying to talk on the air about the FCC letter to the nine nets and bulletin broadcast operations about the net mess on 14,313. I've also asked about the request for the ARRL president to decline his nominations for another term. While several of those contacted had read the limp-wristed condemnation of the Bouvet Island DXpedition QRM in *QST*, it was noted that no calls were listed as QRMers! On 2m I contacted 12 local stations. Five had heard about the 20m QRM mess and the FCC letter. Only two (*73* readers) had heard about the ARRL president. One Extra Class got nasty, "If it isn't in *QST* it isn't true." One advantage of being out here in Seattle is that I don't hear the K1MAN broadcasts.

Yes Byron, I know about the poor, brainwashed ARRL members who are completely unable to think for themselves. Sometimes I look at my 50-year pin and shake my head . . . Wayne

Dorian Blasdell, Grants Pass OR: I'm 17 and working on my Tech license. I've tried to get several of my friends interested, but they can't seem to believe that the code isn't as hard as they think it is. I don't know if there's a local ham club or not. None is listed in the phone book and I've seen no mention of meetings or classes in the paper. Keep publishing articles on ATV, SSTV, VHF, UHF, digital and satellite communications.

Barbara Friend, Warren NJ: I'm not a ham myself. I'm a foreign language H.S. teacher and was shown your May issue by a friend. I am impressed by the education articles about Mary Duffield and Carole Perry. I've gotten some good ideas from what I read. I think that Carole Perry's approach is applicable to what I'm doing and I intend to contact her. I thought you'd like to know that some of your otherwise technical articles made an impact on a non-technical reader.

Diane Prucher, Los Angeles CA: As a third grade teacher trying to get started in ham radio and to bring along children from kindergarten to eighth grade, I appreciated very much the May, 1990, issue of *73*. It was just about the only item I could find in West Los Angeles to get started with. Mr. Green's upbeat and aggressive editorial gave me personal hope that in time children will be able to access the wonderful world of electronics through radio. They have the ability but society has more pressing priorities than its children at this time.

N4XAN: In just about every shortwave/ham magazine there is usually a listing of the frequencies that will be used by WA3NAN, W5RRR and W6VIO for retransmission of space shuttle audio. WA3NAN at the Goddard Space Center, Greenbelt, MD, broadcasts on a 24-hour basis. I would ask that all amateurs assume that the frequency is in use. In a time when we are looking for ways to attract the younger set to ham radio, having a service such as is provided by these three clubs can be a real Godsend. Let's all try to give these frequencies plenty of "elbow room" (1 kHz just isn't enough). Often, new hams and SW listeners (potential hams) don't have sophisticated equipment to IF shift, vary bandwidth and notch out somebody who wants to talk about the weather and his rig. If we all can pay a little attention, space shuttle missions can be a fun time for all. I know two little boys who really like to come into my shack to listen! By the way, thanks to all who did leave the frequency courteously after being told it was in use. Thank you & 73s to all!

WA2ANG: I enjoy reading *73 Amateur Radio* and frankly one of the reasons I buy it is because of your editorials. I find you are right on the mark most of the time. You are a mover and a shaker and ham radio as well as our society needs conceptualizers and movers. We've become a lazy lot. I would like to see more advanced technical articles and was quite surprised to hear that this would be overwhelming to so many readers. . . . When I talk to someone I try to ask them about their work and hobbies other than radio and customs. I often tell people about my work and they say, "Oh, that seems so interesting." . . . I would like to know your thoughts on UFO detection , mentioned in the March issue. Do you believe they are a figment of people's imagination or that their gravity control field is orthogonally rotated from our present electromagnetics?

Hmm. UFOs? Well. It doesn't seem reasonable to me that so many thousands of people have been lying, crazy or confused all these years. I published an editorial in 73 a while back explaining what I think UFOs are and why we'll never pin them down . . . Wayne

NB6Y: In reference to the letter in the April, 1990, issue titled "Electric Blanket Mod Supply", I'm afraid that KE0UV changed his electric blanket from one bad frequency (60 Hz) to another (0 Hz plus 60 Hz ripple). May I recommend reading *Cross Currents* by Dr. Robert O. Becker M.D. (Jeremy P. Tarcher, Inc., 1990)? Melatonin secretion in human subjects may be changed at will by exposure to steady magnetic fields of the same strength as the Earth's geomagnetic field (0.2–0.6 milligauss). Melatonin is the hormone produced by the pineal gland, . . . normally adjusted according to the day/night cycle (biocycle). The effect of an abnormal biocycle is the production of chronic stress syndrome, decline in the immune system, etc. Exposure of a dividing cell to an unhomogeneous DC magnetic field causes a physical force to be exerted on the chromosomes or on one of the other microscopic structures associated with mitosis, . . . resulting in structural abnormalties in the chromosomes. As to the ripple, loss of consciousness can be produced by nulling out or reversing the flow of the brain's DC electrical information system with external DC currents or strong, steady magnetic fields. A greater loss of consciousness occurs with the addition of ELF frequencies (to 100 Hz) to the baseline DC current or magnetic field. Although exposure to strong DC magnetic fields, up to 15 gauss, had no effect, exposure to much smaller fields modulated at ELF frequencies produced significant measurable activities in the human brain, i.e. behavioral changes of an undesirable nature by altering the basic operation of the brain. . . . So get rid of your electric blanket, your waterbed heater and your waterbed (noxious rays). Move or replace that electric clock on the nightstand two feet from your head. At two feet you're getting five to ten milligauss.

It doesn't take much of a filter to smooth out the ripple and thus avoid the AC field . . . Wayne

Kent Britain WA5VJB: Keep up the microwave articles. They are the future of amateur radio more than 20 meter DXing. You used to run around with Gunnplexers, so you understand. We have eight members of the North Texas Microwave Society in the Dallas area on 10.368 GHz SSB. These SSB rigs have a 40-50 dB advantage over Gunnplexers and plenty of scatter margin. 100-mile SSB contacts have become routine. Mountain topping? On the plains of Texas? These paths are 90% beyond the horizon!

So how about some articles, Kent? . . . Wayne

John Rodgers K0KYQ: The Gordon West code tapes got me to 5 wpm, but that wasn't good enough to make many contacts. I bought the ARRL tapes, but they were so poor in quality that it was difficult to tell the dots from the dashes. After 18 months I passed the 13 wpm test and now I'm happily making CW contacts. There's less QRM on CW and ops are more courteous.

Hmph, you've tried the rest, now try the best . . . see Uncle Wayne's tapes . . . Wayne

KJ6UX: I would like to acknowledge your initiative in recent editorials (. . . de K6MH, April 1990) in taking the global view of amateur radio as a participative intellectual exercise: "What would you like ham radio to be? I ask because right at this stage, you may be in a better position to bring it about than you realize. Radio amateurs are an asset to society, and they are a force. If we really get it together—coherent, proud, self-regulating, curious, innovative, vigorously self-respecting, our global fellowship could surface as one of the greatest forces for good on this planet." By bringing such people as Joseph Campbell and David Bohm into your editorial "conversations" you are taking the risk of being tuned out, but perhaps an infusion of "new thought" is the only thing that will save the amateur radio service. Obviously hams in general are protecting our frequencies from being taken for meaningful purposes, as Rich Richmond KA5S points out in the *73* February issue. Thanks again for prodding us to revive the concept of genuine heart-to-heart communication.

Thanks for the feedback, Nick . . . Jim

KC2CF: I must admit right off that I'm not a regular reader of *73*; . . . I must also admit that I'm not a very active ham. The ticket has been stuck on 2m for a long time now. I'm finally in the process of putting up a stick and getting an HF voice again after 10 years or so . . . So why am I writing you? Because of your ". . . de K6MH" column titled "Who's Killing Ham Radio?" (May, 1990) . . . You want more reasons that ham radio is dying? It's because of the wall of exclusivity that the amateur community has built around the hobby. It starts at the very bottom—at the retail stores that sell equipment. Try stepping into one and pretending that you know nothing about the hobby. You'll be completely lost. The products are all labeled like you are expected to know advanced engineering, and the sales personnel make no effort to talk up the hobby in simple language . . . Everyone tries so hard to sound like an expert. They all use the most complicated words to say the simplest things. Look at amateur equipment ads. Amateur equipment magazines. They're all the same. High-tech language. High-tech specs. Where's the fun? Why can't we talk up the light side of the hobby? Why doesn't a retail store hang out a sign that says "come on in and talk to the world"? Why don't we say to our neighbors that hamming is fun? In the "old" days of peaking and dipping, it might have been a problem. But today, with broadbanding, the engineers have left us free to enjoy the fun part of the hobby. Let's stop pretending that we're all Ph.D.s. Another problem is with the manufacturers. A couple of years ago I dropped out of the corporate lifestyle and decided to try to make a living and have fun at the same time (radical idea, eh?). I had this idea of opening a retail ham business with a new twist. I would go after exactly the young people and beginners that are missing from our ranks. I had a really interesting marketing plan to make it happen. And you know what? It was like banging my head against a wall to even get the manufacturers to return my phone calls and letters. The barriers were so well put up (to protect the exclusivity of their current dealers, I assume) that I was soon discouraged. The techniques varied from simply ignoring me to wanting everything from a five-year business plan, an enormous opening order, and a fully-staffed full-time repair department. Never mind that I was ready to invest my time and money in building their business in ways that HAD to work. They were simply not interested . . . It's just such a shame that here we sit, holding on to a hobby that could be, once again, the province of the young; an alternative to so many of the horrible things that kids get into these days. The equipment is easier than ever to use, and maybe soon no code. Ham radio could be BIG, but it will continue to slide downhill because we are so scared that the public will find out how little we hams REALLY know about electronic theory, and how easy it is to talk to the world.

W4UMC: Your editorial suggestions (. . . de K6MH, March 1990) may be well taken in some cases but the bottom line is that ham radio is a hobby and therefore means different things to different people. Since it's a hobby, each person is entitled to do his own thing even if it means talking about the new equipment that he just purchased for an arm and a leg. I have since listened across many bands and indeed find all types of subjects being discussed. I listen on the HF bands more than I talk and I have heard a great many interesting QSOs. Many more were routine, some were most educational, even brilliant, along with the deteriorating, argumentative, destructive, inane and ignorant vulgarity that advertises the inferior mental level behind the voice box of its owner. However, in our case this is a hobby being exercised in a free country, by free individuals of wide, if not extreme, diversity but with a common interest in THIS hobby, its equipment, modes, antennae, joys and the so-called cocktail converstions about and between fellow hams. Such discussions shouldn't seem unnatural or undesirable. In fact, some people are indeed turned off by discussing politics, special interest groups, etc. Some may need a prod but for most of us it's "enjoy" or QSY. But please, let's always "Live & Let Live." 73

73 AMATEUR RADIO

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THE TEAM

PUBLISHING STAFF
Wayne Green W2NSD/1
Jim Morrissett K6MH/1

EDITORIAL STAFF
Wayne Green W2NSD/1
Jim Morrissett K6MH/1
Bill Brown WB8ELK
Hope Currier
Linda Reneau KA1UKM
Joyce Sawtelle
Mike Nugent WB8GLQ
Arnie Johnson N1BAC
David Cowhig WA1LBP
Mike Bryce WB8VGE
Michael Geier KB1UM
Jim Gray W1XU/7
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Brian Lloyd WB6RQN
Andy MacAllister WA5ZIB
Joe Moell K0OV
Bill Pasternak WA6ITF
Arliss Thompson W7XU
Bob Winn W5KNE

ADVERTISING STAFF
Pamela Dass
Dan Harper
Lisa Niemela
Donna DiRusso
1-603-525-4201
1-800-225-5083

PRODUCTION STAFF
William Heydolph
Alice Scofield
Susan Allen
Linda Drew
Viki Van Valen
Ruth Benedict
Dale Williams
Peri Adams
Dan Croteau

CIRCULATION STAFF
Janet LaFountaine
To subscribe: 1-800-289-0388

BUSINESS STAFF
Tim Pelkey
Jerry Bellerose
1-603-525-4201/FAX 4423

Editorial Offices
WGE Center
Forest Road, Hancock NH 03449
603-525-4201
Subscription Services
1-800-289-0388
Colorado/Foreign Subscribers
call 1-303-447-9330

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WGE Center
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phone: 603-525-4201

Advertising Offices
WGE Center
Hancock NH 03449
phone: 800-225-5083

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WGE Center
Hancock NH 03449
phone : 603-525-4201

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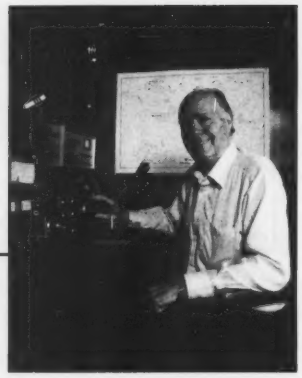
Contract: This is a legal document. Merely by reading this, you are agreeing to get out of your everlasting rut and try something new—like packet or OSCAR. This will keep you from making the Silent Key list without living a little.

Number 2 on your Feedback card



NEVER SAY DIE

Wayne Green W2NSD/1

Self-Policing?

When I visited Russia a couple of years back I was amazed to see firsthand what the Russian people put up with. I saw long food lines, even at midnight. I saw empty store shelves. And everything Russian-made seemed shoddy.

Now we're seeing some Russians saying, "We've had enough of this." But others, used to being guaranteed a living, whether they work or not, are resisting change.

As I remembered this experience I was struck by the parallel with bankruptcy of amateur radio today in America. We have a growing number of hams who are crying out in frustration over 25 years of stagnation and really fed up with the mess our bands are in.

On the one hand we're annoyed that the FCC has let amateur radio disintegrate to such a state. On the other we are increasingly worried that they are going to get fed up with us and do away with our hobby entirely.

I hope it will not be surprising to you to know that the FCC is governed by appointed politicians and run by bureaucrats. It also should be no news flash for you that though there are some government agencies which are doling out billions to eagerly waving hands, the FCC has been on a starvation diet for years.

So we view the FCC with annoyance and fear. How do you think the FCC sees us? Have you ever considered that? Well, on the one hand we brag about being self-policing. Then on the other, the first thing we do when we have a problem anywhere is file a complaint with the FCC. Self-policing? Give me a break!

Yes, I've discussed this in my editorials and recommended that every amateur take this self-policing concept seriously. I've asked that you stop turning to the FCC when you have a beef and figure out how to solve it yourself. Deaf ears. Thousands of deaf ears. Okay, I guess I can accept that you are too afraid to make waves . . . too lily-livered to stand up for what you know is right. I have a solution for you. It's one you're going to hate even more than my asking you to assume some personal responsibility on the air to help clean up our messes.

Speaking of messes, KV4FZ, the chap who's largely responsible for the mess on 14,313, stopped by my booth at Dayton. Herb seems to have dedicated his life to destroying amateur radio, all in the name of protecting it from a few maritime amateurs who are, in his mind, abusing our bands. The cure is infinitely worse than the disease. I found him utterly impervious to reason. Just what we need, a religious zealot willing to explode his version of a car bomb on 20m, wiping him and us out in the process.

So what's the answer to net jamming? To repeater wars? To ham suers? To pileups? To world class lousy operating such as a recent DXpedition which, taking absurdity to extremes, won a Dayton Hamvention award? The mind boggles.

The answer actually is simple, even if you hate my printing it. I'm going to tell it as it is. If your reaction is that I'm bashing the League, instead of sulking about it and hating me, I'd like you to point out in what way you think I'm wrong.

We're supposed to be self-policing, right? I hope we agree this is the way to go. Doesn't that put the responsibility flat on the doorstep of our national ham organization? What in heck is a national organization for, if it isn't to to see that its field is growing and healthy?

The ARRL, for completely self-serving reasons which I've explained in detail in my past editorials, managed, by accident, to halt amateur radio growth 25 years ago. In the process this also virtually wiped out the American ham manufacturing industry. And since the worst debacle in amateur radio history the League has done virtually nothing to improve the self-policing of our bands, to promote the growth of the hobby or provide leadership.

QST magazine, handbooks, contests and awards we've had. A cleaning up and rebuilding of our hobby we haven't had. It isn't as if we couldn't do what needs to be done, it's that we haven't had the leadership it takes.

We've got a thousand ham clubs which would be glad to pitch in and help clean up the mess on our bands. We've got hams working on newspapers, radio and TV stations everywhere who'd help keep the costs of a national PR effort minimal. Heck, massive PR is a cinch to get when you know how . . . I've produced a $99 video which tells exactly how to do it. We're using my PR system right now to promote our Astounding Sounds Audio/Music Tour and we're getting tremendous media coverage everywhere our caravan is stopping between New Hampshire and Chicago.

Here's The Program

1) The League should establish a Special Communications Team at headquarters. They should then make sure that every amateur is made aware that any problem they have should be reported to the SCT. This would include messes such as on 14,313 kHz, repeater wars, ham suers, antenna restrictions, serious TVI complaints, and so on.

The SCT, with the help of local ARRL affiliated clubs, should then Quash Radio Messes and make sure none of them ever even get to the FCC.

The SCT should take the initiative to convince their ARRL affiliated clubs to form QRM committees to help resolve interference, antenna legislation or other legal problems. Even the awful mess on some Southern California repeaters could, I believe, be cleaned up this way.

2) The League should establish a headquarters task force with the mission of rebuilding the growth of our hobby. This team could organize the national PR effort needed to get word out about our hobby to youngsters. We need to establish visibility if we're going to get kids to consider hamming instead of computer games.

Such a team would prevent nonsense like the current no-code mess which the ARRL Board of Directors screwed up so badly . . . making us look like idiots (again) to the FCC.

Such a team might even help prevent stuff like the embarrassing secret ARRL submission of a proposed digital communications rule change to the FCC which, once word got out, had to be retracted.

What Next?

Okay, let's say first that you disagree with me . . . that you think Wayne Green is all wet again. Let's say that you don't believe that the ARRL has any responsibility whatever for solving amateur radio problems or promoting amateur radio growth. Who then? The FCC? Why them? All they do is license us to use billions of dollars in radio frequencies . . . supposedly for the interest, convenience and necessity of the public welfare.

Just how providing amusement for a shrinking group of rapidly aging cantankerous old men is in the interest of the general public, I'm not sure. I'd hate to be faced with proving it in court. Heck, the rental income from our microwave bands alone would go a long way toward reducing the national deficit.

The FCC is so enthralled with the value of amateur radio that they cut the ham division staff from 18 down to two and a half people. No, I don't think we're going to find the leadership we need in Washington.

Perhaps you believe we shouldn't try to fix it just because it's broke. Maybe we should just continue on as we have and enjoy hamming as long as we can and not worry about the future. Is that what you want?

Those few who may agree with me that (a) something should be done and (b) the League is the only organization we've got to do it probably are feeling the same sense of frustration I am. No amount of my griping either on the air or in my editorials is going to unleash anything except retribution from the League. They won't get moving, they'll just get even. So if I can't get any action, how can you hope to do it?

No, one person can't do much against such a bureaucracy. In Russia they used to send individual troublemakers off to the gulag. But now, with hundreds of thousands getting together to complain, even the incredibly well-entrenched party officials are being thrown out.

One ham can't do much to change the League. Heck, we've recently seen four very influential hams try to convince the ARRL directors not to re-elect Larry Price as president. Their well-reasoned plea fell on blind eyes. Price's response was to attack the messengers, not the message. So he's president again.

One of the directors was so upset over what's been going on in the League that he made a special trip to visit me and ask me to help encourage the members to get rid of the party hacks who now dominate the board. He explained that these entrenched old-timers hold the membership in total contempt.

He pointed out that not one ARRL member in a hundred even bothers to try and read the highly sanitized board meeting minutes published in *QST*. Few bother to spend a dollar to get the Annual Report and fewer ever read it. So all most members know is just what the board and HQ wants them to know, no matter how far this is from reality.

I don't want to turn this into a *NY Post* scandal expose, even though I've been given documentation on corruption which would cause heart failure to true believers. The Silent Keys list is long enough as it is.

Let's ignore the messes for now and go to curing both their causes and to

Continued on page 80

KENWOOD

The DXpeditioner!

TS-440S

Compact high performance HF transceiver with general coverage receiver

Portable reliable performance and ease of use makes the TS-440S your obvious "low bands" choice. It is "Every Ham's" rig to go — ham shack, portable or mobile. But don't let the small size fool you — there's lots of "big rig" performance packed into this package. Built-in antenna tuner option. Continuous duty transmitter. Super DynaMix™ front end. Five filter functions. The TS-440S is at your service wherever you wish to operate.

- **Covers all Amateur bands** General coverage receiver tunes from 100 kHz–30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
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- **Superior receiver dynamic range** Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m.)
- **100% duty cycle transmitter** Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB. 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Computer interface port**
- **Adjustable dial torque**
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- **TU-8 CTCSS unit (optional)**

- **MC-43S UP/DOWN mic. included**
- **Superb interference reduction** IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and opt. filters fight QRM.
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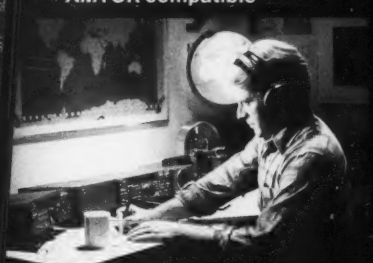
- **AMTOR compatible**



Optional accessories:

• **AT-440** internal auto. antenna tuner (80 m – 10 m) • **AT-250** external auto. tuner (160 m – 10 m) • **AT-130** compact mobile antenna tuner (160 m – 10 m) • **IF-232C/IC-10** level translator and modem IC kit • **PS-50** heavy duty power supply • **PS-430** DC power supply • **SP-430** external speaker • **MB-430** mobile mounting bracket • **YK-88C/88CN** 500 HZ/270 Hz CW filters • **YK-88S-88SN** 2.4 kHz/1.8 kHz SSB filters • **MC-60A/80/85** desk microphones • **MC-55** (8P) mobile microphone • **HS-4/5/6/7** headphones • **SP-41/50B** mobile speakers • **MA-5/VP-1 HF** 5 band mobile helical antenna and bumper mount • **TL-922A** 2 kw PEP linear amplifier • **SM-220** station monitor (no pan display) • **VS-1** voice synthesizer • **TU-8** CTCSS tone unit • **PG-2C** extra DC cable.

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144/450 and 144/220 MHz FM Dual Banders

- Extended receiver range (136.000 – 173.995 MHz) on 2 m; 70 cm coverage is 438.000 – 449.995 MHz; 1-1/4 m coverage is 215 – 229.995 MHz. (Specifications guaranteed on Amateur bands only. Two meter transmit range is 144 – 148 MHz. Modifiable for MARS/CAP. Permits required.)
- Separate frequency display for "main" and "sub-band."
- Versatile scanning functions. Dual scan, and carrier and time operated scan stop.
- 30 memory channels. Stores everything you need to make operating easier. Two channels for "odd splits."
- 50 Watts on 2 m, 35 watts on 70 cm, 25 watts on 1-1/4 m. Approx. 5 watts low power.
- Automatic offset selection.
- Dual antenna ports.
- Automatic Band Change (A.B.C.) Automatically changes between main and sub-band when a signal is present.
- Dual watch function allows VHF and UHF receive simultaneously.
- CTCSS encode/decode selectable from front panel or UP/DWN keys on microphone. (Encode built-in, optional TSU-6 needed for decode.)
- Balance control and separate squelch controls for each band.
- Full duplex operation.
- Dimmer switch.
- 16 key DTMF/control mic. included.
- Frequency (dial) lock.

Optional Accessories:

• **PG-4H** Extra interface cable for IF-20 (for three to four radios) • **PG-4J** Extension cable kit for IF-20 DC and audio • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SWT-1** 2 m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-41** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-700** Dual band 2 m/70 cm mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

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"Dynamic Duals"

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QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Harrison Incarcerated

On April 19, 1990, Judge Jacob Mischler sentenced Harrison to 21 months in prison, a $125,000 fine, full restitution plus interest to each victim within five years, and three years of probation after he completes his jail term. Additionally, Harrison must pay $1,210 per month to the Bureau of Prisons for his confinement costs. Harrison has agreed to return any equipment he received from victims. The United States Probation Department, Long Island Courthouse, Uniondale Avenue and Hempstead Turnpike, Uniondale, NY 11553 will supervise the restitution. The Case Number is CR89-00575.

Martin T. Biegelman, on behalf of the United States Postal Inspection Service, thanks all of you who have assisted him in the successful investigation and prosecution of Michael Harrison. *And thank you, Inspector Biegelman, for keeping our staff and readers informed of the status of this case.*

RUDAK-2 Launch

The launch of RUDAK-2 and RADIO-M1 (RS-14), planned for April 12, 1990, was delayed because of a problem in GEOS, the geological research satellite, also part of the payload. AMSAT expects RUDAK-2 to be launched this month. All analog and digital transponders of the new RS bird have been tested and proclaimed ready.

Downlink frequency of RUDAK-2 is 145.983 MHz with a nominal output power of 2 watts rf PEP (max. 12 watts). Uplinks are on 435.016 MHz for 1100 bps (yes, 1100) Manchester FSK (just Fuji-OSCAR-20 and the MicroSats) modulation, 435.155 MHz for 2400 bps BPSK, 435.193 MHz for 4800/9600 bps RSM modulation and 435.041 MHz for Digital Signal Processing (DSP) experiments.

Before you use these uplink frequencies, check to make sure that RUDAK-2 has been fully commissioned by the RUDAK command stations. TNX *The AMSAT Journal.*

PR Docket 90-55

The ARRL Committee studying PR Docket 90-55 released its report in May, signed by First Vice President George Wilson W4OYI. While subject to board acceptance in July, the committee states that what the FCC is offering and what the ARRL will accept are very different. Briefly, the committee recommends:

1. Retaining the Novice Class license is essential.
2. Novice testing should be incorporated into the VE system.
3. VECs should be permitted to recoup examination expenses, provided no exam fees are charged to applicants under 16.
4. The Technician Class license must be retained.
5. Element 3A should be expanded by five questions. (Requirements would be as follows: Novice, Elements 1A (5 wpm code test) and 2; Communicator, Elements 2 and 3A; Technician, Elements 1A, 2, 3A. Upgrading from Novice to Tech would require passing Element 3A; upgrading from Communicator to Tech would require Element 1A.)
6. Certificates of Successful Completion should be issued to applicants who pass either Element 1A or 2 without qualifying for a license by passing another element.
7. Frequency privileges for Communicators should be as proposed in RM-6995, and 200W PEP output is acceptable. However, since the 5 wpm code test would be the only difference between the Communicator and Technician qualifications, the committee could find no rationale for denying Communicator control operator privileges for repeater and auxiliary stations. Therefore, the committee recommends that the board reconsider the matter.
8. Technicians who have credit for Element 3B under the present licensing structure should retain this credit for upgrade to General after passing 1B (13 wpm code test).
9. In all other respects, that there be no departures from the ARRL position adopted in RM-6995. TNX *Bill Pasternak, Amateur Radio Newsline, and ARRL News.*

High Altitude Balloon Flights

Several weather balloon flights carrying amateur radio equipment going up to 100,000 feet in altitude are planned this summer. At this altitude the signals should be received more than 400 miles away from the launch point. You can obtain launch updates and information from the following sources: The ATV Net—3.871 MHz, 8 p.m. EDT Tuesdays; the AMSAT net—3.840 MHz at 9 p.m. EDT, 9 p.m. CDT, and 8 p.m. PDT every Tuesday; packet BBS systems nationwide, and the *73 Magazine* phone line BBS (under the ATV SIG) at (603) 525-4438. Launch schedule:

- June 30, 9 a.m. EDT. WB8ELK, *73* Headquarters, Hancock New Hampshire. (Come on up for the launch. Bring direction finding equipment if you wish to join in the tracking effort.)
- July 7, 9 a.m. CDT. KD0FW, Independence MO.
- July 14, 1300 UTC. K4BV, Crystal River FL.
- July 21, 9 a.m. CDT. NJ9Y, Champaign IL.
- To be Announced, W0RPK/WB8ELK/KA8TEF/KA8LWR, Des Moines IA & Bucyrus OH.

For a more complete description of these flights and frequencies, see this month's ATV column. TNX *to our editor, Bill Brown WB8ELK.*

Computer RF Virus?

The Army Communication Electronics Command has proposed to award a grant of up to $50,000 to a small business for initial study of Topic A90-217, "Computer Virus Electronic Counter Measures." The focus is on RF as a method to introduce viruses, according to the Department of Defense (DOD).

The grant is part of the DOD Small Business Innovation Research Program (SBIR), which makes financial grants for exploratory projects. For general information on the SBIR program, contact Bob Wrenn, OSD/SADBU, US DOD, Pentagon Rm. 2A340, Washington DC 203301-3061. (202) 697–1481. TNX *W5YI Report.*

Uniden for Education

Uniden America Corporation is offering a quantity of their HR-2510 transceivers to schools who have a licensed radio amateur on staff authorized to operate on 10 meters. The school must agree to install the equipment. When it is no longer in use, for whatever reason, the equipment must be returned for redistribution to another user. The radio cannot be sold or "re-donated."

The HR-2510 operates between 28.0 and 29.7 For information on how to apply for an HR-2510, contact Paul Davis at (817) 858–3300. TNX *Uniden.*

ARRL/CRRL Conference

The deadline for camera-ready papers is August 6, 1990 for submissions to the joint ARRL/CRRL Computer Networking Conference. If you wish to submit a paper, write Lori Weinberg at the ARRL (225 Main Street, Newington CT 06111) for an author's package. Or call (203) 666–1541; FAX (203) 665–7531.

Topics include, but are not limited to, HF packet, packet satellites, network development, hardware, protocols, software, packet services and future systems. This year the conference will be held in Canada, in London, Ontario on Saturday, September 22, 1990.

TNX again . . .

To all our contributors. You can reach us by phone at (603) 525–4201 or by mail *73 Magazine*, Forest Rd., Hancock NH 03449; on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; GEnie, "MAG73"; and the *73* BBS at (603) 525–4438 (300–2400 bps), 8 data bits, no parity, one stop bit.

AEA's Amiga Video Terminal (AVT) Master SSTV and FAX System

Imagine sending and receiving high resolution color or black and white images and photos via radio transceiver OR telephone. And then imagine the ability to "erase" QRM and noise effects. With AEA's new AVT (Amiga Video Terminal) Master System, you get pixel perfect pictures. The AVT Master offers 55 SSTV (Slow-Scan TV) modes, many in up to 4,096 simultaneous colors with a resolution from 128 by 120 up to 640 by 400. Nine FAX modes in resolutions up to 1,024 pixels by 1,200 lines in 16 grey levels are also possible. The AVT offers every known SSTV commercial and experimental mode, as well as WEFAX, NEWSFAX and GEOS FAX (with optional board). This is a major breakthrough for SSTV and FAX enthusiasts!

Flexible Hardware. Five separate receiver inputs allow you to attach a two-meter, six-meter, HF and SWL rigs plus a tape recorder...all at the same time! Plus there's an RJ-11 telephone jack. Simply plug in your phone line to the interface unit and transmit a full-color image in about 12 seconds. Both positive and negative transmitter keying, as well as individual tape recorder and transmitter audio outputs provide the ultimate connection. You don't ever need to touch the box...all controls, including system audio output levels and input selection are accomplished on-screen using the Amiga mouse.

High Performance. The AVT is already in use every day, passing high quality images across the continental U.S. and from Florida to Hawaii. Images sent with the AVT may be damaged as much as 50 percent by QRM and QRN, and still be recovered by the system so that it's almost impossible to tell there was ever any interference. Built-in image processing and signal conditioning ensures the best picture quality, picture after picture.

Compatibility. You can receive ANY known SSTV or HF FAX signal...the AVT supports all modes, including the new European modes to the older color composites to black-and-white SSTV to 60/120/240 LPM FAX transmissions. Multiple aspect ratios provide the right picture when monitoring those unusual FAX stations, too. All of these modes are available in full transceive. The images received by the system are compatible with every paint program, digitizer, frame grabber and scanner currently available for the Commodore Amiga, allowing unparalled flexibility and artistic freedom.

Revolutionary. The AVT also offers new SSTV formats that easily outperform ALL pre-existing modes...integral data recovery, narrow bandwidth, full color, multi-image (3-D) with LCD goggles-not provided, multiple resolution and synchronous transmission.

AVT image received.

Intuitive. Every command is presented in a logical, consistent series of menus and control panels. Sophisticated tools such as a detailed oscilloscope simulator aids tuning. The system even transmits an "Alignment Signal" to ensure a quick match in frequency between systems when operating SSB. When you have a question, a 140-page comprehensive manual will provide you with the answer. Should you need further assistance, AEA's staff of trained technical support personnel can be contacted at (206)775-7373.

Feature-Packed. Built-in capabilities include: Tuning oscilloscope. Mode-to-mode conversions. Interpolating zoom. Image inset. Brush "Clipart" (file artwork) cut and paste, including transparent background. Image tinting, brightness and contrast control. Thresholding. Black-and-white and color histograms. Text overlay using multiple fonts, boldface, italics and underlining in any combination or color. Automatic CW and synthesized speech ID after transmit. Extensive macro and script capability (with ARexx program). Custom color bar generation. Luma conversion and image averaging. Black-and-white and color negatives. Eight function

Transmitted image in process of being restored after heavy QRM.

damaged scan line "Repair Kit." Multiple mode full- frame intelligent image cleanup with sensitivity control. Owner defined FAX demodulation curves. Image rotation and flipping. Paint capability. Extensive ARexx language support. Real-time software filtering for scope and receive operations. Up to 16 high-resolution image memories at one time. Grab screens to transmit from any digitizer or operating program in real-time. Transmit and receive sequences of images using multiple memories. One button automatic reception of most SSTV modes. Automatic start and run at any time...catch those midnight FAXes without being there. Copy and exchange between image memories. On-screen DTMF pad. Image printing in both black-and-white and color on literally hundreds of different printers. You can even tell the system what to do remotely (with ARexx program), via packet and/or RTTY using standard TNC's such as AEA's high performance PK-232MBX multi-mode data controller.

Updates. Since the AVT is a software driven system, there aren't any costly ROM and hardware updates. Occasional updates will be provided on a disk. Simple, inexpensive and fast.

Inexpensive. The good news is that you can purchase the AVT and an Amiga computer system for less than a popular new SSTV system costs! If you already own the computer (minimum of one and one-half megabytes of memory recommended), the AVT suggested amateur net price through AEA's authorized dealers is only $299.95. For further information, contact your local AEA dealer or AEA corporate headquarters at (206)775-7373, P.O. Box 2160, Lynnwood, WA 98036.

CIRCLE 65 ON READER SERVICE CARD

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Foxhunt Radio Direction Finder

Homing in by sight and sound.

by Paul Bohrer W9DUU

How often have you wished for a simple RDF which could work on just about any band and provide you with both an aural and visual means of determining the direction of a signal? You may have wanted to find an errant transmitter, QRM source, participate in a serious search and rescue mission, or just have fun finding the "fox." Now you can do it.

Many DFers in the Indianapolis area have built and used the unit described here. The circuit processes information from two quarter- or half-wave antennas, and gives right or left indications of which way to turn the antenna or vehicle so you can aim at the source. This type of DF is called "homing" because it tells you which way to go to home in on the signal. It is not affected by signal strength, and as such will allow you to take readings on the move. This helps you to average out multipath problems. You might bear in mind, however, that signal strength readings are still valuable, as they help confirm when you are almost "on top of" the fox.

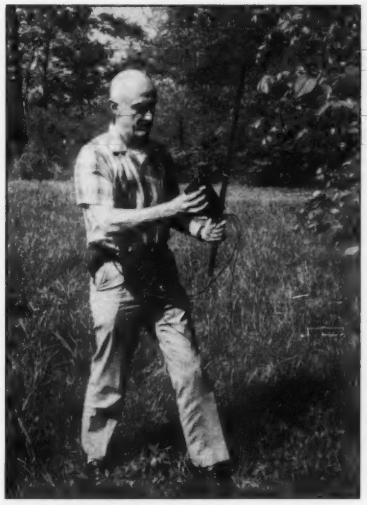

Photo A. Paul W9DUU with phase array DF unit in action.

Photo B. The W9DUU DF unit. The earlier model was hand-wired. The new model uses a PCB.

How the Circuit Works

IC-1 produces a square wave signal which is used to switch between the two antennas at an audio rate. The square wave from IC-1 also feeds through Q1, 2 and 3 with the result that there are square wave signals of opposite polarity applied to each side of the Ø-center meter.

When no audio signal from the receiver is present, the 5k zero pot is adjusted so that equal amplitudes of opposite polarity square wave signal are developed across the 100 µF cap and the meter, with respect to the 4 volts reference from pin 6 of IC-2. Therefore, no DC voltage develops across the cap and meter, so the meter reads Ø center.

When a signal arrives at both DF antenna dipoles at the same time (the antennas are the same distance from the transmitter), the receiver FM detector will have no output since it sees no phase difference in the signal arriving at each antenna.

As soon as the antenna is rotated slightly, the FM detector in the receiver will produce a tone, the frequency of which is determined by the rate at which the antennas are switched. This tone is caused by the signal arriving at one antenna slightly sooner or later than the other. Due to this difference in travel time, it arrives at each antenna with a different phase.

This phase difference comes out of the receiver in the form of positive and negative pulses. See Figure 1(a). When these pulses are fed through the zero adjust pot to the meter, a DC voltage will develop across the 100 µF cap and meter, and the meter will deflect, say, to the left. If we rotate the antenna so that the opposite dipole is now closer to the signal source, the pulses out of the receiver reverse in polarity. See Figure 1(b). An opposite polarity DC voltage now develops across the 100 µF cap and meter, so that the meter deflects to the right.

Our circuit in effect is operating as a phase detector. This small DC voltage, developed across the meter, is used to turn on the upper left section of the 339 quad comparator when the meter swings left. When this happens, pin 2 goes low and turns on the upper right section, causing pin 13 to go low and turn on the left, or green, LED. When the antenna is rotated so that the meter swings from left to right, the upper two sections turn off and

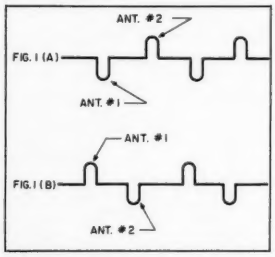

Figure 1. Pulses created by phase difference between the two antennas.

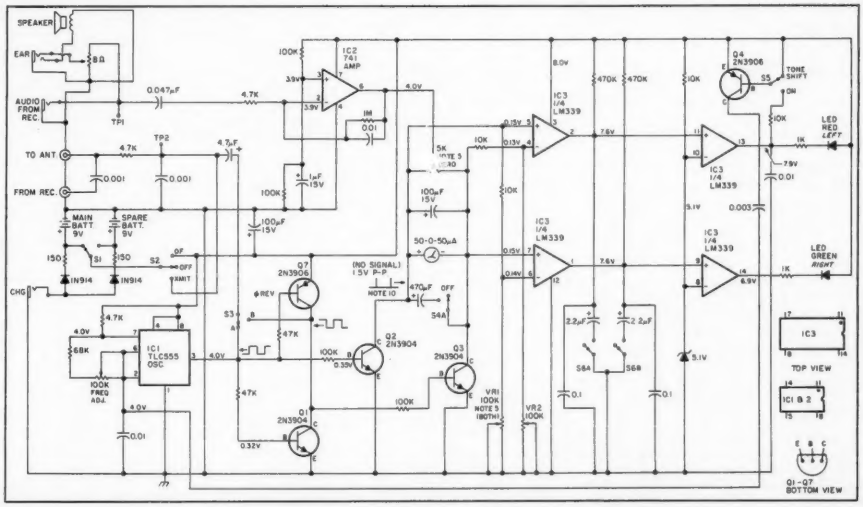

Figure 2. Schematic for the RDFing circuit.

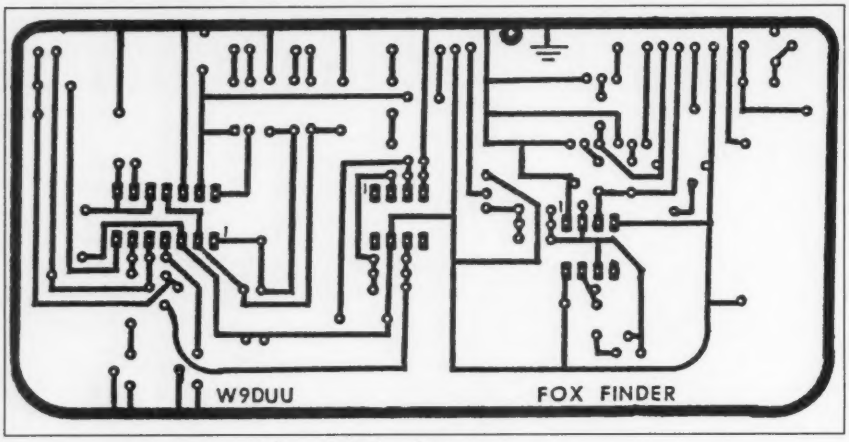

Figure 3. PC board pattern.

Table 1. Parts List

Qty.	Part	RS#	Qty.	Part	RS#
1	555 timer	276-1718	1	0.047 µF	272-134
1	741 op amp	276-007	2	0.1 µF	272-135
1	LM339	276-1712	1	1 µF 35V tantalum	272-1434
3	2N3904 or equiv.	276-2016	2	2.2 µF 35V tantalum	272-1435
2	2N3906 or equiv.	276-2023	1	4.7 µF 35V elect. axial	272-1012
2	ECG 553 pin diode		2	100 µF 35V elect. axial	272-1026
1	5.1V zener diode	267-565	1	470 µF 16V elect.	272-957
2	1N914 diode	276-1122	1	5k PC mount pot.	271-217
1	red LED	276-041	3	100k miniature pot.	271-284
1	green LED	276-022	1	8Ω stereo fader control	270-047
1	p.c. board	276-168	3	mini SPDT, S-1,S-3,S-5	275-625
1	box (user choice)	270-223	1	mini SPDT (center off), S-2	275-325
2	mini jack	274-247	1	mini SPST, S-4	275-624
1	mini plug	274-286	1	mini DPDT, S-6	275-626
1	coax power jack	274-1565	2	150Ω	271-1312
2	SO-239 jack or BNC	278-201	1	470Ω	271-019
1	2" speaker	40-245	2	1k	271-1321
2	battery snap connector	270-325	3	4.7k	271-1330
2	9V NiCd battery	23-126	4	10k	271-1335
2	9V bat. holder	270-326	2	47k	271-1342
5	0.001 µF	272-126	1	68k	
1	0.003 µF (use 3 of the 0.001 µF caps)		4	100k	271-1347
3	0.01 µF	272-131	2	470K	271-1354
			2	1MΩ	271-1356
			1	50–0–50 uA center zero panel meter	

Note: Meter Sources:

Any center zero meter can be used as long as its in the 50 to 100 microamp deflection range. The Radio Shack 0–15 volt panel meter can be used by moving the indicator to center position with the position screw. Also the following two companies have appropriate meters:

A 100–0–100 uA meter (part # MHE 5) is available from Hosfelt Electronics, Inc., 2700 Sunset Blvd., Steubenville, OH 43952. Phone: (800) 624–6464.

For a larger meter display you can use the Triplett 320-WS which is available from A.R.E. Surplus, 15272 S.R. 12 E, Findlay, OH 45840. Phone: (419) 422–1558. Blank PC boards are available from the author for $15 ppd.

Table 2. Construction Notes

1. Battery voltage = 8 when readings were taken. V on LM339 pins 1, 2, 4, 5, 6, 7, 13 and 14 depends on the setting of VR 1 and 2.
2. Battery drain = 7 mA no signal, and about 13 mA with signal applied (L or R LED lit).
3. Antenna and receiver jacks should be counted as close together as possible. Use short leads on the two 0.001 caps and the 4.7k resistor. Mount the 4.7k resistor at the antenna jack.
4. The length of the coax between the antennas and the switching diodes is not critical, however they should be exactly the SAME length.
5. Adjust the meter zero pot for zero meter reading. Adjust VR 1 and 2 so that the LEDs just extinguish. (No signal applied.)
6. With signal aplied, rotate antenna for maximum meter deflection. Adjust the receiver audio level to just produce full scale meter deflection.
7. Adjust the oscillator frequency for equal left-right meter deflection with signal applied. Use the highest frequency possible. Some radios will have more phase distortion at lower tone frequencies, and can even cause the circuit to show reverse direction reading.
8. Use S-4 in the ON position for averaging meter flutter when in high multipath areas, turn S-6 on to store LED left or right readings when DFing kerchunckers. Do not turn both S-4 and S-6 on at the same time as this will adversely affect your reading. Leave both switches in OFF position for normal DFing.
9. Circuit test: Connect a 1k resistor between TP1 and TP2. Meter and LED should produce a right reading with phase switch S-3 in the ON position and a left reading with S-3 in the OFF position.
10. The 8Ω stereo fader control potentiometer is used to control the volume to your earphone or external speaker independently of the audio level from your rig into the RDF unit.

the lower sections turn on, causing the right or green LED to light.

Returning to pin 13 of the 339 for a moment, notice transistor Q4 in the upper right corner. Its base can be connected to pin 13 via the tone shift switch. If S-5 is turned on, whenever pin 13 goes low, indicating a signal to the left, it will turn on Q4. This transistor serves as an electronic switch; when on, it switches the 0.003 µF capacitor (which is connected to the collector) to the supply bus.

This produces the same effect as connecting the 0.003 capacitor across the 0.01 cap which is hooked from pin 2 to ground of IC-1. The frequency of the 555 oscillator is lowered, causing the pitch of the tone heard from the speaker to go lower. Therefore, a LOW tone indicates LEFT, and a HIGH tone indicates RIGHT. Instead of watching the meter or LEDs, you can listen to the pitch of the tone. This will buy you points with your local police and your insurance agent (no collision forms to fill out—I'm sure they would prefer that you watch the traffic instead of your DF unit)!

Returning to the circuit, the two 2.2 µF caps connected to S-6a and S-6b are used as sample and hold capacitors. When S-6 is positioned to ground the negative side of the two caps, they provide a two-second delay indi cation of the LED or tone direction reading. This is helpful when DFing kerchunkers

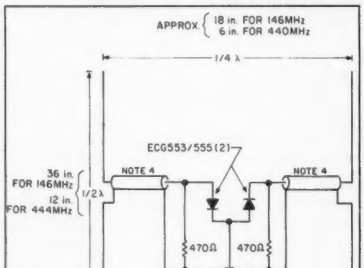

Figure 5. Antenna construction.

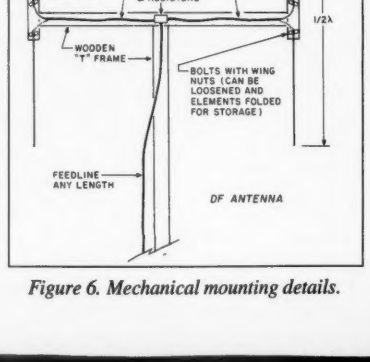
APPROX 1/4λ
STIFF WIRE ELEMENTS
50 OHM COAX EQUAL LENGTH
WOOD OR PLASTIC
PC BOARD WITH DIODES & RESISTORS
1/2λ
WOODEN "T" FRAME
BOLTS WITH WING NUTS (CAN BE LOOSENED AND ELEMENTS FOLDED FOR STORAGE)
FEEDLINE ANY LENGTH
DF ANTENNA

Figure 6. Mechanical mounting details.

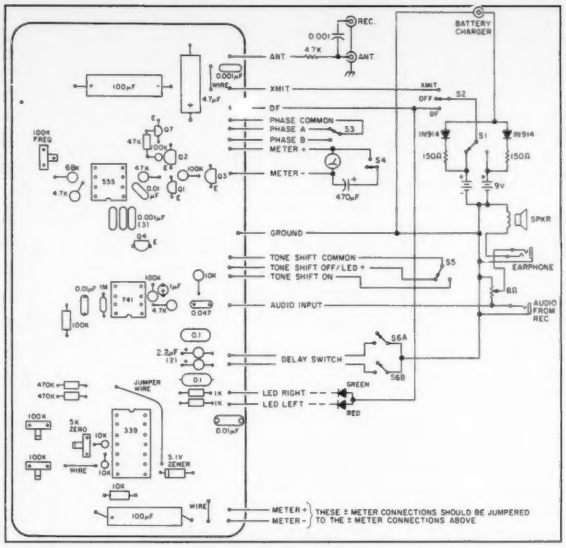

Figure 4. Parts placement.

or scanner local oscillators. See note 8 in Table 2.

Using the W9DUU DF Unit

The phase reversal switch S-3 is used in case you change receivers to a different one which may have the opposite polarity of audio output signal. This has the same effect as having your antenna backwards—your readings will also be reversed. I suggest a small label or legend on the DF unit to remind you of which position the phase switch should be in for each radio you may use. Otherwise, you may end up trying to find the fox in the wrong direction.

Like any other DF unit, you should practice with the equipment until you become familiar with its operation, and using it becomes automatic. There are always enough other things to provide distraction and confusion (multipath in particular), and you don't need to add unfamiliarity with your equipment to the list.

Construction is not critical, other than two items—see notes 3 and 4 in Table 2. You will no doubt want to build it in a rugged manner to survive the environs of mobile/portable operation and trekking through the wilds.

I hope this circuit may provide others some of the enjoyment I have had from the sport of foxhunting through the years. 73

Paul Bohrer W9DUU is an engineer for WISH-TV channel 8 in Indianapolis. You may reach him at 1813 Lilac Drive, Indianapolis IN 46227. This article was reprinted from ATVQ, *April 1989. Blank PC boards are available from the author for $15 ppd.*

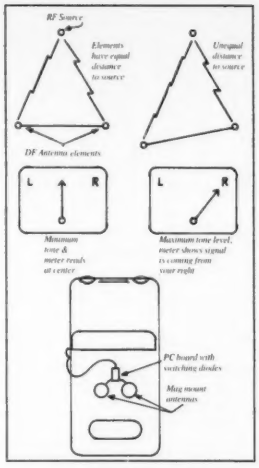
RF Source
Elements have equal distance to source
Unequal distance to source
DF Antenna elements
L
R
Minimum tone & meter reads at center
Maximum tone level, meter shows signal is coming from your right
PC board with switching diodes
Mag mount antennas

Figure 7. Operating hints: a) If tone sounds raspy and has high frequency overtones, you probably have some multipath signals. Move your position (if stationary) until tone sounds pure (no multipath signals). b) Take readings at high elevation and away from buildings, if possible. c) If in a vehicle, take readings on the move, and average out the meter fluctuations. d) Mobile antenna can be made from two quarter-wave mag mounts on roof of car. Watch for signal source direction change as you change direction of car.

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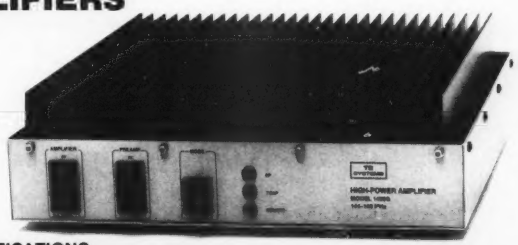

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0552G	50-54	25	400	.6	15	13.6	55	UHF
1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	.7	14	13.6	36	UHF
4450G	420-450	10	175	1.1	12	13.6	34	N
4452G	420-450	25	175	1.1	12	13.6	29	N

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CIRCLE 233 ON READER SERVICE CARD

The Hidden Receiver Hunt

Exciting sleuthing without expensive equipment.

by Robin B. Rumbolt WA4TEM

Nowadays, to compete effectively in a VHF or UHF transmitter hunt, you'd better have a Doppler unit or be prepared to settle for an "also participated" award. Hidden transmitter hunts have been providing sleuthing minded amateurs with the excitement of solving radio whodunits for years. I know of several groups who have become so proficient at finding transmitters that hunts with only one hidden transmitter are becoming too easy. Since the introduction of Doppler shift direction finders, loops and beams have been relegated to last resort status.

To extend the excitement of radio signal sleuthing to those not possessing high powered direction finding gear, I propose the idea of the hidden receiver hunt. That's right, I said hidden receiver hunt! No, this is not a watered down fox hunt with location descriptive clues being sent out. This type of hunt still requires map reading and triangulation skills, and it still requires practice to know which bearings are real and which are only reflections. Time is still a factor. You can still hunt multiple receivers. Best of all, you don't need any fancy DF gear to find the hidden receiver. This is a perfect activity for hamfests or club meetings, a unique twist on an established amateur radio sport!

The Mechanics

How does it work? Simple. The hidden receiver has the Doppler type DF unit attached to it. That means only one DF unit is required. Mobile units call the fox unit and ask for bearings indicating the direction from the fox to the mobile unit.

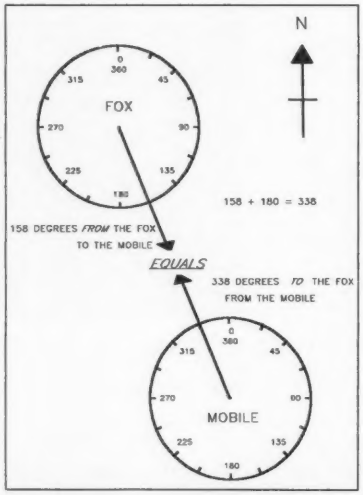
Suppose there are a group of mobiles trying to find the hidden receiver. Each mobile in turn asks the fox for the indicated DF bearing the fox to the mobile. When a mobile receives his direction bearing from the fox all he has to do is add or subtract 180 degrees from it to get the bearing to the fox. Add 180 if the received bearing is less than or equal to 180 degrees. He then plots this derived bearing on a map. A little later when the mobile has moved to a different location, he can ask for a second bearing. In a flat, open area this may be enough to get a fair idea of the fox's location. Here in the mountains of East Tennessee, we have a problem with reflections which necessitates numerous bearing requests, and provides a bit more challenge for fox hunters. The same will be true in metropolitan areas. It takes practice to tell a reflection from a "real" signal. So don't expect to ace these hunts without practice.

At the beginning of the hunt, each mobile has a score of zero. Each time a mobile asks for a bearing, five points is added to his score. If the mobile asks for a signal strength reading as well, an additional five points is added. The time of each mobile's first bearing request is also recorded. Each mobile has one point added to his tally for each minute of elapsed time between his first bearing request and the time he locates the fox. The hunt isn't over until all mobiles have found the fox or given up trying. Then, the mobile with the lowest score wins.

The Requirements

The only equipment each mobile must have is a radio capable of communicating with the fox, an accurate map of the hunt area, a protractor and a pencil for plotting bearings, and maybe a magnetic compass.

The fox must have a Doppler type direction finding system attached to a sensitive receiver with an S-meter that is separate from the radio he is using for communications with the mobiles. He needs a magnetic compass for getting set up. He will also need to have a log for keeping score.



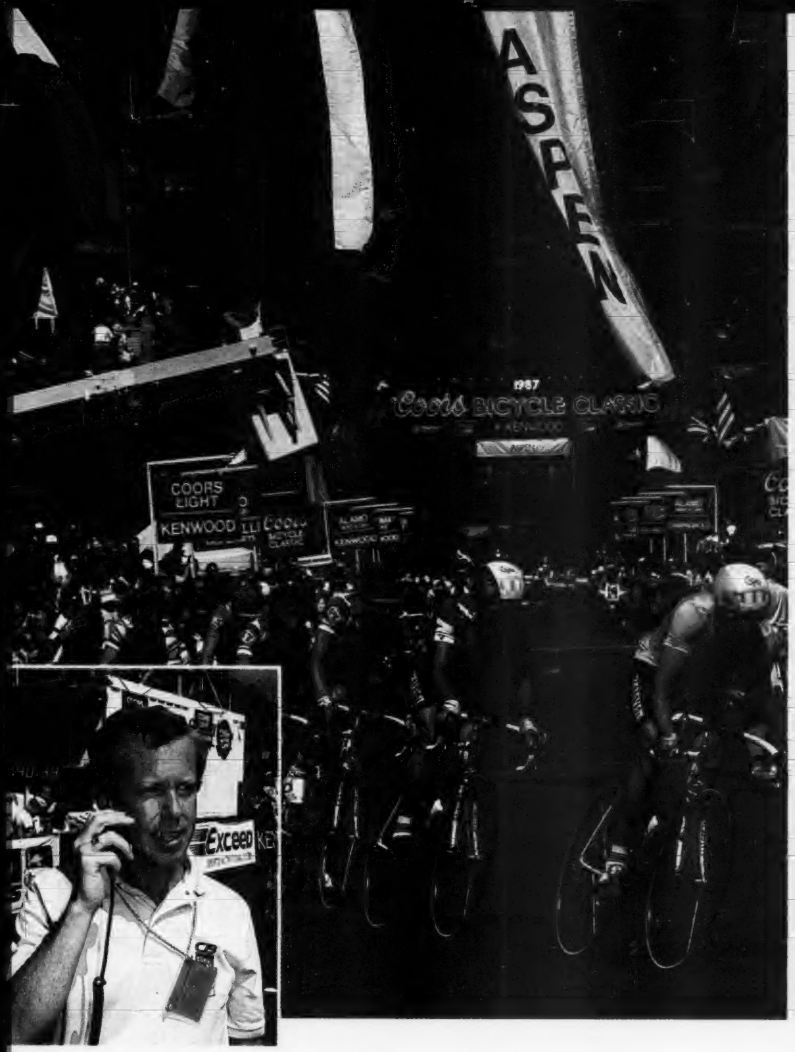
The fox's setup is important since he will be providing the bearings on which everyone else relies. His DF unit must be aligned to north properly. The zero or 360 degree mark on his DF unit antenna must be aimed north. If all mobiles are using maps based on true north, then the DF unit must be aligned with true north. If the mobiles are using magnetic compasses, then the DF unit should be aligned with magnetic north. There is a difference. A call to your local airport should put you in touch with someone who knows what the difference (magnetic declination) is in your area. Pilots have to know that stuff. Here in Tennessee the difference is one degree. Big deal, but I had to mention it.

The fox should communicate with the mobiles through a repeater if the hunt area will exceed simplex range. As is true many times in VHF/UHF hunts, the trick is not so much locating the fox once you have the signal. The trick is getting close enough to the fox to hear the signal at all. It's the same in a hidden receiver hunt. The fox has to be able to hear the mobiles. He must also know when they have started hunting for score keeping purposes. If a mobile asks for a bearing or signal report and the fox can not hear him, that's valuable information for the mobile too. The mobiles should operate through the repeater. The fox should listen on the input of the repeater for getting DF bearings, and listen on the output of the repeater for communicating with the mobiles.

Mobiles having DF equipment can also participate in these hidden receiver hunts by tracking down the fox's reply transmitter signal. Fun can be had by all. If you're having a hidden receiver hunt and a hidden transmitter hunt combined, does that make it a hidden transceiver hunt?

I would like to thank Lyle Juroff K9FIK, a true DF nut, for helping me with the hidden receiver concept, and for nagging me into writing this article. 73

Contact Robin B. Rumbolt WA4TEM at 1134 Glade Hill Dr., Knoxville TN 37909.



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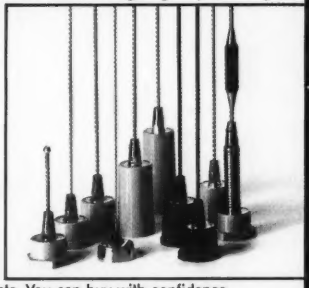

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CIRCLE 60 ON READER SERVICE CARD

Ten-Tec Service

Exceptionally personal . . .

by Gordon West WB6NOA

What a pleasure it is dealing with Ten-Tec! This wonderful factory with wonderful people is located in a "back home" surrounding in Sevierville, Tennessee. It has a unique distinction that sets it apart from all of the other amateur radio manufacturers—their equipment is built in the United States of America! It's good to see staying power after we have seen companies like Swan (Cubic), R.L. Drake, and Collins redirect their marketing efforts to commercial communications, away from amateur radio equipment.

To unfounded rumors, Sid Kitrell W0LYM/4, Vice President of Marketing at Ten-Tec, says, "Reports of our demise have been greatly exaggerated! We are alive and well. We also enjoy the largest share of the HF transceiver market than ever in our history. . . One of the greatest reasons for our continued success is our product support and service. We are fast, economical, and thorough. Typical turnaround time is five working days or less. When customers call, they talk to the tech that works on the model that the customer owns. Our service is the envy of the industry."

73 Magazine readers evidently agree—I received over 20 letters of praise for Ten-Tec service and no letters of dissent. Charles Ziegler W8RV wrote, "Just make sure your upcoming articles on service include Ten-Tec. I have had Kenwood, Yaesu, Drake, Ten-Tec, and Collins equipment, and each required service at one time or another. The Ten-Tec service provided the best and quickest repair of all—make sure your survey doesn't leave out Ten-Tec."

Here are the facts I discovered about Ten-Tec service:

- Average turnaround time: 5 days or less.
- Most common service problem: component failure.
- Most common problem with equipment arriving from customer: little documentation of problem or symptoms.
- Warranty period, no charge for labor: 1 year; Titan amp, 3 years.
- Warranty period, no charge for parts: 1 year; Titan amp, 3 years.

Hourly charge for out-of-warranty repairs: $45.

- Average repair cost for most HF failures: $65.
- Turnaround time for parts orders: 3 working days.

Regarding out-of-band modifications: "Seldom do we see any out-of-band modifications attempted on our equipment."

Ten-Tec sends out a ". . . we have received for repair your Ten-Tec . . ." postcard, as well as a follow-up estimate on the repair charges. Their repair bill goes into detail on what took place at the technician's bench. "Ten-Tec Model 540, serial number 2524, replaced antenna relay and D4 and D5 on SWR-ALC board. Replaced dial cord. Replaced antenna jack. Realigned PTO, and realigned SSB generator. Check TX and RX—3 hours, set works great." The postcard includes a job number for positive identification, with room for any special notes.

Photo A. These new transceivers, made in the U.S.A., are inspected for completeness.

Photo B. At Ten-Tec, you can speak directly to the service technician who is working on your rig.

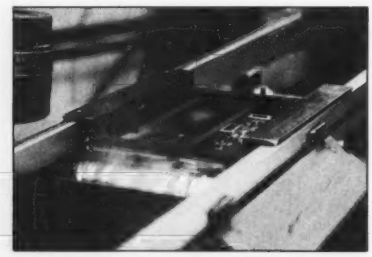

Photo C. All boards are wave-soldered to ensure positive connections.

More "Firsts" than Anybody Else

What would the Ten-Tec service manager like for customers to do before they call up? Attempt to troubleshoot the rig for the problem. And here's a first: Ten-Tec will send a replacement board for an easy swap! No other company we visited offers circuit boards swap-outs. In fact, most companies made it quite clear that replacement circuit boards were just not available for most of their equipment. At Ten-Tec, they're plentiful.

Here is another first from Ten-Tec: When Ten-Tec discovers that a component or other type of problem is causing recurring failures in a set, they ". . . send out a service bulletin to all of our registered equipment owners." This means that Ten-Tec sends out repair bulletins directly to the customer, even though the customer may not be having any problem with the equipment. Ten-Tec keeps its customers informed of potential, as well as actual, problems.

Ten-Tec service personnel indicated that there are at least 12 Ten-Tec dealers that may provide in-store service for their equipment. While Ten-Tec has no "emergency repair" available at the factory, I did notice a fellow passing through their city come in with a minor problem, and get it fixed during the lunch hour. Ten-Tec personnel also indicated that their servicing dealers will sometimes repair a set on the spot if it's a quick fix.

Ten-Tec continues to fix even their oldest of transceivers. "We have parts that go back for twenty years, and we still maintain stock of specialty mechanical devices, such as tuning assemblies," a Ten-Tec serviceman says.

And here's a third rarity in the service

- Service center incoming phone number: (615) 428–0364
- Parts department: same number as above
- Service Manager: Larry Worth
- Questions on operating your Ten-Tec equipment: (615) 453–7172. If this number is busy, call the service center number.
- Write Ten-Tec at 1185 Dolly Parton Parkway, Sevierville TN 37862. And, of course, package your rig well.

business: Ten-Tec is about the only one that actually lets you speak directly to the repairman working on your particular set. "This way, nothing gets lost in the translation—and here at Ten-Tec, no translation is necessary." As I scribbled this comment down during my visit, I thought it appeared to be a friendly swipe at the competing Japanese service bench technicians.

More from the Mailbox

Robert Ballinger N6QQO backs up this claim. "On June 26 I sent to Ten-Tec a very old, and very tired, and somewhat abused by its original owner transceiver. Garland Jenkins in the repair shop was extra courteous on the telephone, and indicated the repair would be under $75 after several items were fixed. Everyone was very polite, and everyone I talked to seemed genuinely interested in my repair problem. Three weeks turnaround time was well worth the wait when you could have seen what condition my set went back to them in, in the first place!"

George Scott W2LFX: "I would like to add my experience with Ten-Tec. In the past 13 years, I have purchased 3 different models; Triton 2, Omni-D, and now the Corsair 1. The few problems I have had were quickly corrected by the Ten-Tec service factory. Immense help was given me right on the telephone without having to send my equipment back. Ten-Tec indicated they would send me the circuit board and asked that the old board be returned within 30 days. Sending out circuit boards to replace bad boards in the field is a delight—and they trust us as hams to return the old board without charging us for the new one."

Scott sums up his feelings, saying, "I guess they are the only ham radio company manufacturing in the U.S.A., and they're giving us the U.S.A. treatment we like."

Allen Fink K9DKJ: "Fast service! They also did some modifications to the power switch without my even having to ask." He adds, "I talked personally with Rick, who was a Paragon repairman. He was a very knowledgeable, helpful, and friendly person. I bought Ten-Tec because it is American made, and I am very happy with the transceiver and service at the factory. What a delight to be able to call the service technician who's actually working on the equipment."

So far, Ten-Tec service has achieved the highest satisfaction among *73* readers who responded to our service survey. I was impressed with the genuine downhome attitude of everyone involved at Ten-Tec. Sid Kitrell of Ten-Tec said, "...we're delighted to learn that we will be included in your service survey. Glad you could come on down and spend some time at our service center."

Ten-Tec service technicians look for problems in a piece of equipment with genuine interest, as if it were the technician's own rig.

Next month, the Yaesu service department rolls out the red carpet for "Gordo" WB6NOA, and makes some late-breaking announcements about regional service centers to back up their new modern service facility in Cerritos, California. 73

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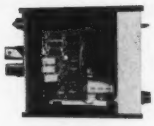

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CIRCLE 348 ON READER SERVICE CARD

Two Meter Tracking Transmitter

Low-cost beacon.

by Carl Lyster WA4ADG

Here's a simple 2-transistor CW transmitter that can generate up to 10 milliwatts of power on the 2 meter band. I originally designed this circuit for use as an animal tracking transmitter for the Tennessee Wildlife Resources Agency.

This circuit has a wide variety of applications whenever a low-cost signal on 2 meters is required. The Indianapolis Foxhunting Club has been using it for their "Easter Egg Hunts." They take several of these transmitters on different frequencies, enclose them in plastic eggs, and scatter them about the search area. The low power allows the trackers to easily walk right up to the hidden eggs without severely overloading their HTs or scanners. The trick comes in attempting to remove the eggs from the middle of thorn bushes!

This transmitter has also been used on two high altitude balloon flights. Its low current drain makes it a good choice for this kind of experiment. It's amazing what 10 milliwatts will do from 60,000 feet, as stations over 300 miles away were able to copy the beacon at an S-5 level. *[Ed. note: The package shown on this month's front cover used one of these tracking transmitters.]*

Circuit Description

To keep this as low-cost as possible, the transmitter was designed to use inexpensive scanner crystals. Most VHF scanners use a third overtone crystal in the 48 MHz range. To find the 2 meter output frequency of a particular scanner crystal when used in this transmitter, just subtract 10.7 or 10.8 (depending on the scanner's IF scheme) from the commercial frequency. For example: a scanner crystal for 155.15 MHz would give the transmitter a 2 meter output on 144.35 MHz if the crystal was made for a scanner with a 10.8 MHz IF. Scanner crystals ranging from 154.8 to 158.7 MHz should put your tracker transmitter in the 2 meter band.

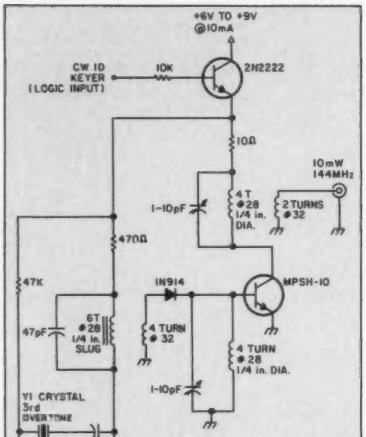

Figure 1. Schematic of the 10 mW transmitter.

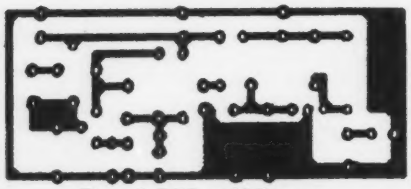

Figure 2. PC Board foil pattern.

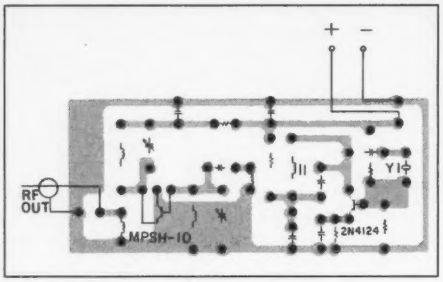

Figure 3. Parts placement.

The oscillator section generates between 5 to 10 milliwatts of RF in the 48 MHz range. The output of the oscillator then drives a simple diode tripler to generate a signal at 144 MHz. The MPSH-10 transistor is used as a class-C amplifier, and it also helps clean up the final RF output. The closest spurs at 96 MHz and 102 MHz are at least 40 dB down.

Supply voltage to the transmitter is controlled by a 2N2222 transistor keyed by a logic level from your favorite CW Ider circuit. *[An appropriate CW IDer was described in the June "Above and Beyond" column. Another excellent choice is the GLB ID-1.]* If too much chirp is present, you might try leaving the oscillator running continuously and just key the final amplifier.

Construction

The circuit can be built on perfboard with point-to-point wiring. However, I've included a PC board foil pattern which will make layout simpler. The 4-turn coil which couples the oscillator into the diode tripler can be wound directly over the 6-turn slug-tuned coil in the oscillator tank circuit. The 2-turn output coil is mounted in line with the collector end of the 4-turn coil in the amplifier tank circuit. Place the 2-turn coil as close as possible to the tank coil for maximum output power.

Tune Up

Build the transmitter up one stage at a time, starting with the oscillator. Apply 6 volts to the oscillator and make sure it's running. You should be able to hear its second harmonic on a stereo receiver set for 96 MHz. If the oscillator fails to start, try varying the slug-tuned coil in the tank circuit until it kicks in solidly. If this fails, you could increase the value of the 4.7k resistor or lower the 470 ohm resistor feeding the tank circuit.

Once the oscillator is functional, build up the tripler and amplifier section and place a small dummy load on the RF output. Adjust the input and output variable capacitors for maximum RF out. A grid dip meter or spectrum analyzer would be helpful at this point. However, you could simply adjust for maximum signal on your 2 meter rig's S-meter. Don't try to get more than 10 milliwatts out of this transmitter, as spectral purity will suffer. There will be some chirp with this circuit, especially if you key both the oscillator and amplifier. Chirp can be minimized through adjustment of the slug-tuned coil in the oscillator.

The transmitter works best with a supply voltage between 6 to 9 volts and draws about 10 mA. Any 9-volt battery should provide a reasonable operating life. For extended transmission times, you could use some of the newer Lithium 9-volt batteries.

The tracker transmitter can be enclosed in some extremely small packages which can be a real challenge to find during a foxhunt. Even though this is a CW transmitter, it can be easily heard with an FM receiver, so everyone can join in the fun! 73

You may reach Carl Lyster WA4ADG at 4412 Damas Rd., Knoxville TN 37921. *This article was reprinted from the July 1989 issue of ATVQ.*

Parts List

Qty.	Part Description
1	2N2222 transistor
1	2N4124 (or 2N2222) transistor
1	MPSH-10 transistor
1	1N914 diode
1	¼" slug-tuned coil
1	Scanner crystal, Y1
	#28 wire, short length
	#32 wire, short length
2	1-10 pF variable capacitor
2	0.001 µF ceramic capacitor
1	47 pF ceramic or mica capacitor
1	10 ohm ¼ watt resistor
1	47 ohm ¼ watt resistor
1	470 ohm ¼ watt resistor
1	4.7k ¼ watt resistor
1	10k ¼ watt resistor
1	47k ¼ watt resistor
1	PC Board

Note: A blank PC Board is available for $3 + $1.50 postage/handling from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

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Feedback# Title

1 Letters
2 Never Say Die
3 QRX
4 Foxhunt Direction Finder
5 Hidden Receiver Hunt
6 Ten-Tec Service
7 Ham Profiles
8 You Are Here
9 Transmitter Hunting Safety
10 12-volt Drive Conversion
11 Return to Kit Building
12 Review: ICOM CT-16
13 Review: Ameritron Coax Switch
14 Hamfest Shopping
15 Turnstile Antennas
16 PK-232 Connect Memory
17 Audio Patch Panel
18 Review: AR-880 Pocket Scanner
19 ATV
20 Hamsats
21 C-64 Inductance/ Capacitance Meter
22 Hooked on Foxhunting
23 Ask Kaboom
24 New Products
25 Packet Talk
26 Special Events
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32 Dealer Directory
33 73 International
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38 Notes from the ELK
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40 Updates
41 Ham Help
42 Two Meter Tracking Transmitter

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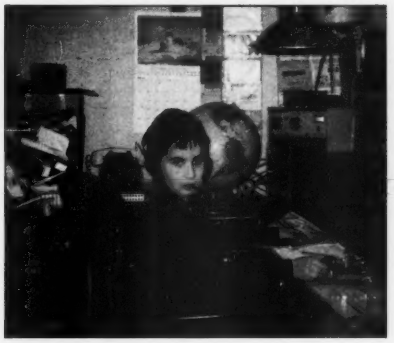
HAM PROFILES

There are no "average" hams!



A Real Brass-Pounder

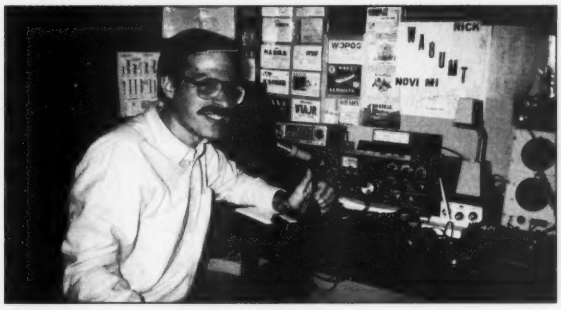
Eight-year-old Avraham "Avi" Moshe Broges KB2JFU is the youngest member of LIMARC and, says Lloyd Mills WB2ZIT, "...a real sweetheart of a kid. His rig is eight times as old as he is and twice as heavy."

The son of Aaron Broges WC2C, Avraham KB2JFU is a third grade student in yeshiva. Space exploration and electronics are among his favorite scientific interests, and he enjoys math and computers. Twice a week he goes to karate class. Other times find him building with Construx™.

According to WB2ZIT, Avraham KB2JFU is "a real brass pounder, so look for him on the CW Novice bands." What he likes the most about amateur radio operation is meeting people all over the world. He's made several DX QSOs, including one with Israel, as well as QSOs all over the country. He also listens regularly to the ARES net.

KB2JFU's father, Aaron WC2C, has been a ham for four years. Late last October, he began coaching his son for the Novice license tests, which Avraham passed in December. This summer, Avraham will study with his father for the Technician Class license. His father knows the secret of successful teaching: keep it fun. To a great extent, this means short but regular sessions. They study theory about thirty minutes a day, and CW about twenty minutes. Aaron says he never pushes his son to study.

CW comes in handy for father and son, as they use it as a private language in other situations. No doubt KB2JFU and WC2C will have plenty to talk about in the years ahead. *[TNX WB2ZIT for sending us KB2JFU's profile.]*



ATV DXer

Rick Redoutey WA8UMT of Novi, Michigan, has been a ham since 1966. His interest in the hobby was sparked when he was given a Heathkit GR-81 receiver for his tenth birthday. As a result of a ham merit badge project in the scouts, he became a licensed ham at the age of 15.

Although you can find Rick on the low bands during contests (most recently in the Michigan QSO party operating from a rare county), he gets the most enjoyment operating Amateur Television (ATV) on 439.25 MHz. In particular he likes the challenge of working DX via this mode.

During his job repairing video products at the Sony factory service center he became intrigued with the idea of using video with amateur radio. Rick decided to try ATV after reading an article describing the 400–500 mile ATV contacts that resulted from the great midwestern band opening during the 1986 Thanksgiving weekend. He immediately jumped into the thick of ATV DXing and has since worked over 50 ATV stations in Michigan, Ohio, Indiana, Illinois, Pennsylvania, and Canada.

Rick currently works as a field service engineer for General Electric Medical Systems.

A Flying Ham

Jim Skala WA8VWY has been a ham since the spring of 1963. He wasn't very active on the ham bands until after graduating with an engineering degree from the University of Akron in 1967. At that time, his primary interests were working on 6 and 2 meters. He combined his love of computers with ham radio and developed an excellent code practice program for the VIC-20 which is still used today by many hams (VWY Code Practice).

Jim is an IFR rated pilot and has logged many hours in his Cessna 182. He will soon be working on a high performance, home-built experimental plane. While working on a consulting job in Bloomington, Illinois, he commuted via his Cessna each week back to Akron, Ohio (a distance of 350 miles). Jim decided to hook up a packet station onboard his plane complete with a Radio Shack model 100 laptop so that he could keep in touch with his friends below. Not only did he make as many as 50 contacts as he flew along, he also allowed stations in a several state area to work through his airborne digipeater alias "AIR." At his cruising altitude of 12,000 feet, connects were made with stations as far away as Iowa and Pennsylvania.

During the summer of 1987, Jim operated ATV from his weekly flight, allowing dozens of hams in Ohio, Indiana, Michigan, Illinois, and Iowa to fly along with him. He provided many ATVers with consistent 140 mile DX contacts from his plane.

When not flying the BIG planes, Jim really enjoys his R/C models which he operates on the 53 MHz ham bands. He loves the fast aerobatic R/C models since he can perform maneuvers he'd never dare with his Cessna. His favorite model is a Northstar Water Plane which he can take off and land on a lake or pond. In fact, it has no wheels of any kind!

Jim currently works at SAIC in Huntsville, Alabama, as a Systems Engineer.

You Are Here

Two ways to prove it.

by Timothy G. Knauer NY9F

In an uncharacteristic move, almost every branch of the U.S. government has agreed to support a single positioning system called the Global Positioning Service (GPS). GPS is one of two prominent, competing systems for locating yourself on the globe. (Actually, there are at least five or six currently used by various government agencies and divisions of the armed forces.) The other prominent system, LORAN-C, is used largely by private aviators and mariners. Although the DOD is withdrawing its support of everything except GPS, the U.S. Coast Guard has vowed support for the LORAN system at least until the end of the 1990s. LORAN is being enhanced to support coverage within the central regions of the United States. This work is due for completion in the spring of 1991.

There are few GPS receivers that are reasonable in price for a consumer product. Current LORAN receivers cost from several hundred dollars to several thousand. (Sounds like ham radio gear?) GPS receivers are as low as $3,000 in single quantities at the low end to about $70,000 for the best surveying equipment. However, look for some GPS board sets for under $1000 later this year. Several Japanese car companies are reportedly working on a GPS system that will display location. The position would be shown on a map drawn from data stored in a CD ROM.

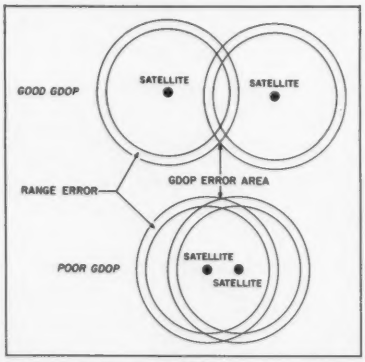


Figure 1. Geometric dilution of precision.

Photo A. Magellan hand-held GPS

GPS is a passive satellite location system. The user is required to carry only a receiver to find his location on the Earth or in low Earth orbit. An unlimited number of users may use the system simultaneously. The system consists of three sections: the satellite constellation, ground support and the users. GPS is sponsored by the Department of Defense (DOD), and therefore some strings are attached.

The Satellites

The full satellite constellation consists of 21 satellites, with three in-orbit spares. The current (May 1990), status is 13 operational satellites providing partial coverage. Partial coverage means that there will be 3-dimensional coverage, but it is not continuous. (Lat., Long. and altitude) However, there will be 24 hour 2-D (Lat. & Long.) coverage beginning mid to late summer of this year. (The NAVSTAR satellites are too large to be launched from anything but the largest expendable launch vehicles and the space shuttle. The Challenger accident was a setback for the program.) The full constellation may be completely operational by 1992. The constellation will provide coverage for all of the continental United States (CONUS), and most of the rest of the globe. Each satellite weighs almost a ton and is placed in one of six circular orbits at an altitude of 10,900 nautical miles. This altitude is about half of the altitude for a geo-stationary orbit, and was picked to provide an orbital period of exactly 12 hours. It is possible to visualize the constellation of satellites as staying fixed relative to the stars, with the Earth rotating underneath. This means that until all satellites are orbited, the periods of coverage will occur four minutes earlier each day.

Ground Support

The GPS system is maintained by the Department of Defense on a daily basis. Ground controllers monitor the integrity of the system, and closely follow the ephemeris (orbital data) of each satellite. Deviations from the predicted orbit are noted and uplinked to the satellite. The satellite can then pass this information along to the users in the form of a correction, resulting in a more accurate position fix.

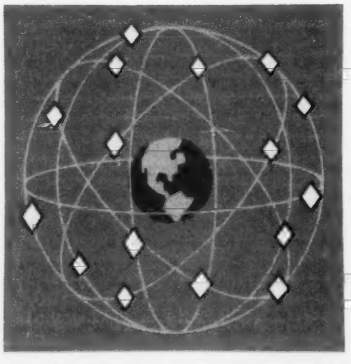


Figure 2. GPS satellite constellation. (Diagram courtesy of Magellan Systems Corp.)

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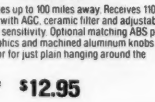
20 MTR QRP Kit QRP-20		40 MTR QRP kit QRP-40		80 MTR QRP kit QRP-80		Case kit CQRP
	$29.95		$29.95		$29.95	$12.95

AIRCRAFT RECEIVER KIT



Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1 **$24.95** Receiver case kit, CAR-1 **$12.95**

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

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PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software, PC board, all necessary parts and full documentation.

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Sensitive superhet FM receiver tunes any 5 MHz segment of band. Listen to ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

2 MTR kit FR-7		10 MTR kit FR-10		220 MHz kit FR-20		Receiver case kit CFR-7
	$29.95		$29.95		$29.95	$12.95

NEW MINIKITS—NEW MINIKITS

BROADBAND PREAMP

A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.

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Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

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Receiver kit, LB-5 **$9.95**

HIGH POWER FM WIRELESS MIKE

A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC

FM-4 kit **$12.95**
Sensitive microphone cartridge **$2.95**

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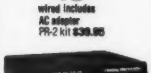
Quality Test Gear & Electronic Kits for Professionals and Hobbyists

PR-2 COUNTER PREAMP

$49.95

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp • 3 db NF

wired includes AC adapter
PR-2 kit **$39.95**



PS-2 AUDIO MULTIPLIER

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The PS-2 is handy for high resolution audio resolution measurements, multiples Up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

wired
PS-2 kit **$49.95**

PS-108 1.5 GHz PRESCALER

$89.95

Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

wired includes AC adapter

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$2795.00 THE COMMUNICATIONS SERVICE MONITOR THAT WORKS HARDER FOR LESS.

Introducing COM-3...the new service monitor designed by service technicians for service technicians. It works harder for less...giving you advanced testing capabilities at a very affordable price.

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MINI KITS—EASY TO ASSEMBLE—FUN TO USE

TONE DECODER
A complete tone decoder on a single PC board. Features 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1 **$5.95**

COLOR ORGAN
See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110VAC.

ML-1 Kit. **$8.95**

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9 VDC.

VS-1 KIT **$6.95**

VIDEO MODULATOR
Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit. JM-7 **$12.95**

LED BLINKY KIT
Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.

BL-1 Kit, **$3.95**

MAG BLASTER
Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit **$4.95**

FM WIRELESS MIKE
Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 Kit **$5.95**
FM-2 Kit **$7.95**

40 WATT 2 mtr PWR AMP
Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 40 W pwr amp kit **$27.95**
TR-1, RF sensed T-R relay kit **6.95**

UNIVERSAL TIMER
Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

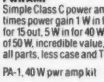
UT-5 Kit **$5.95**

WHISPER LIGHT
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W. runs on 110 VAC.

WL-1 Kit **$6.95**

SIREN
Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 **$3.95**

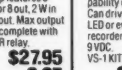


SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.

BN-9 Kit **$5.95**

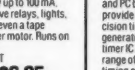
80 Hz TIME BASE
Runs on 5-15 VDC. Low current (25ma) 1 min/month accuracy

TB-6 Kit **$5.50**
TB-6 Assy. **$9.95**



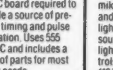
TELEPHONE TRANSMITTER
Low cost with professional performance. Features include; self phone line powered, tunable from 76 to 100 MHz, polarity antisensitive, compact size (1⅞" x 1¼"), easily installs anywhere on the phone line or inside the instrument itself.

PB-1 KIT **$14.95**



FM RECEIVER
For built-in applications or hobby experimentation. Full fledged superhetrodyne receiver, microvolt sensitivity, 10.7 MHz IF, integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception

FR-1 KIT **$14.95**



FM MINI MIKE
A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$16.95**
FM-3 Wired and Tested **19.95**

NEW

MICROWAVE INTRUSION ALARM
A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.

Complete Kit, MD-3 **$16.95**

NEW

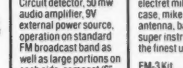
SPEECH SCRAMBLER
Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC DSM circuitry. Can also be used to descramble most com. scramblers.

Complete kit, SS-7 **$29.95**
Case kit, CSS-7 **12.95**

CT-70 7 DIGIT 525 MHz

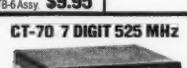
$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz



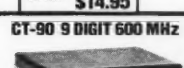
$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz



$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz



$189.95 WIRED INCLUDES AC ADAPTER

FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	19.95
Direct probe, general purpose use	13.95
Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 Mhz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

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TERMS: • satisfaction guaranteed • examine for 10 days: If not pleased, return in original form for refund • add 6% for shipping and insurance for a maximum of $10.00 • foreign add 15% for surface mail • COD add $4.00 (COD in USA only) • orders under $20.00 add $3.00 • NY residents add 7% sales tax • 90 days parts warranty on all kits • 1 year parts & labor warranty on all wired units.

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Photo B. Interphase LORAN C

Because the system is primarily a military program, there are some caveats. The system is intended to have two levels of accuracy: one for civilians and one for the military. The military had hoped for accuracies of 10 meters SEP. A maximum accuracy for civilians was to be about 30 meters SEP. In practice it has been shown that military accuracy can be achieved using the civilian system. Therefore, the DOD has a policy of S/A: Selective Availability. In short, they reserve the right to degrade the quality of the civilian code to approximately 100 meters accuracy. It is uncertain when and if the policy would be implemented. It is probable that it would be used only in times of national emergency, and for testing purposes. Also note that 100 meter accuracy is an exceptional positioning ability. Should S/A be implemented, the user will be aware of the error, but unable to resolve it. By using a technique known as differential GPS, positional accuracies across several kilometers can be on the order of millimeters.

User Segment

The user segment consists of both civilian and military users. A typical receiver system will have three parts: the antenna, receiver/navigation computer, and a Control Display Unit (CDU).

The navigation solutions consist of latitude, longitude, altitude and time. While under 2-D coverage, altitude is unknown, or assumed to be constant. Additionally, the computer may also calculate velocity and direction. Navigation solutions may be produced as often as once per second. A data block from a GPS receiver should also contain a figure of merit. This would represent a statistical weight of the errors that a user can determine. (Some errors can't be determined by the user.) It is a measure of the accuracy of the navigation solution. Navigation data is usually available through a serial port.

GPS Positioning Principles

GPS positioning is based on knowing the distance to a group of satellites. GPS satellites transmit signals that tell the user exactly where it is in its orbit and the exact time that the signal was sent. Knowing the time it took for the signal to arrive provides the range to the satellite because the speed of a radio signal (speed of light, about 300,000 km/s) is a known constant.

With one satellite, the user's location could be narrowed to anywhere on a sphere, centered on the satellite. With ranges to two satellites, the user location is limited to a circle described by the two overlapping spheres. With a third range, the location is narrowed to one of two points where the three spheres overlap. One of the solutions is probably ridiculous, or gives an absurd velocity, and can be disregarded. A fourth range would unambiguously describe the user's location.

The obvious problem is, "How do all parties agree on time?". The satellites have an expensive solution. They each have four atomic clocks that can be reset by ground controllers when they drift. This works well for the satellite segment, but is unrealistic for the users. User clocks would have to be synchronized periodically, and would not be allowed to drift under any conditions of environment. A radio signal requires 10 µs (ten millionths of a second) to travel about 3000 meters. This puts a tremendous constraint on clock accuracy and drift. Fortunately there is another way. The user needs four pieces of information: latitude, longitude, altitude and time. This is very much like a set of algebraic equations, four equations and four unknowns.

Therefore, the remedy is a fourth ranging measurement. Geometrically the extra solution provides a set of impossible locations: A user cannot be in more than one place at a time. By adjusting the receiver clock in such a way that the solutions converge, the timing errors can be eliminated. The key is to remember that any timing errors on the part of the user will be off by the same amount, no matter which satellite is used. The satellites all agree on what time it is.

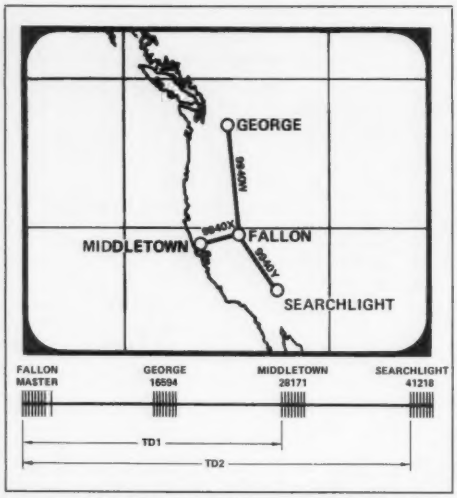

Figure 3. LORAN C time differences of the West Coast chain. (Chart courtesy of Micrologic.)

GDOP (Geometric Dilution of Precision)

GDOP (pronounced "GEE-DOP"), is an error that is known to the user, but cannot be resolved. It is a direct result of the satellite geometry. The best configuration of four satellites (the simplest case) would be three satellites near the horizon, spaced at 120 degrees, and one near the zenith.

Each satellite range has an uncertainty, therefore it is referred to as a pseudo-range. Depending on the geometry of the satellites with respect to the user, the uncertainty can be exacerbated. In Figure 1., two satellites with their pseudo-ranges overlapping, the navigation solution must be within the overlapping regions. The relative positions of the satellites determine the size of the box, and

Photo C. Micrologic hand-held LORAN C

therefore the error attributed to GDOP.

The receiver may also have to go through a restart process if it was moved (about 100 km) while powered down or without satellite coverage. It may take longer to make the first navigation solution, but the user should not have to become involved in providing approximate time and location. Once a satellite has been acquired, the unit can receive ALMANAC data for the the rest of the constellation from the single satellite. The almanac data includes ephemeris and health data for the rest of the satellite constellation.

GPS Antenna Placement

NAVSTAR satellites must be visible to the user; that is they must be in a line-of-sight to the antenna. (Navigation solutions are valid for the antenna position.) A minimum of three satellites are required for a 2-D solution and four are required for a 3-D solution. (A 2-D solution is a position on a map and time. 3-D solutions are latitude, longitude, altitude and time.) The satellite signals do not penetrate dense foliage, buildings or hills. GPS antennas do not look like traditional mobile

"whip" antennas. In fact, they can be formed to a very low profile.

A Brief Description of Spread Spectrum

To the casual observer, a radio station operates on an assigned, single frequency: for example, 107.9 MHz. As hams know, only perfect sine oscillators occupy a single frequency. The commercial FM station in the example actually uses a set of frequencies—a bandwidth—of about 30 kHz, centered on 107.9 MHz.

This type of transmission is called narrowband. It means that the useful information in the signal is contained in a relatively narrow bandwidth. This is the way most radios operate. A narrowband signal is susceptible to natural and man-made noise. They are also inherently subject to deliberate interference.

In 1939, techniques were found to spread a signal over a broad spectrum of frequencies. The energy in the signal is spread over a range of 10 to 100 times the bandwidth required for a narrowband signal. The total energy is the same. This lowers the signal-to-noise ratio, and makes the transmission invisible to traditional narrowband receivers. A receiver that complements the spread spectrum transmitter can be built to recover the information in the signal, even though the signal may have less energy than the natural noise at that frequency. In addition to being naturally "stealthy," the spread spectrum transmission is almost impossible to deliberately jam. Because of these properties, the technology remained a secret until after World War II. (In fact, Churchill and Roosevelt used an ingenious spread spectrum technique to communicate throughout the war.) Spread spectrum technology remained classified until publication in the Journal of the IRE by Shannon, in 1949.

Spread-spectrum technology also allows satellites to share the same set of frequencies without interfering with each other.

GPS Applications of Spread Spectrum

GPS uses a system of two frequencies in L-Band; specifically 1575.42 MHz (L1) and 1227.6 MHz (L2). There are two distinct spread spectrum signals sent by each satellite. Each signal follows a different spreading code. The two codes are referred to as the C/A and P code. The C/A code (Course or Civilian Acquisition), is transmitted only on L1. The P-code (Precision or Privileged) code is transmitted on both L1 and L2. Civilian use of GPS is limited to the C/A code. The P-code is a pseudo-random code: a pattern that repeats every 267 days. Military users are given a "key" that allows their receivers to reconstruct the P-code anywhere along in its sequence. In this instance, the C/A code is used to sync-up with the more precise P-code.

Ionospheric diffraction causes the satellite signals to take a longer and less predictable path to the user, thereby introducing a timing error into the solution. The use of two frequencies allows military users to significantly decrease the error caused by diffraction.

Various models for ionospheric diffraction have been used in C/A code receivers. This is one way that civilian users have achieved near-military accuracies. It is also possible to operate a differential GPS setup without any knowledge of the P-Code, and still get 1 ppm accuracies, or better.

LORAN-C Description

LORAN-C is a refinement of a system that was first implemented in the 1950s. Like GPS, it is a passive system. Users are required to have receivers only. Time information can be derived from LORAN transmissions, but it is not intrinsic to the system data. Altitude information is not available from the system. The system provides a 2-D position on a map. Accuracies are somewhat less than can be achieved with GPS. Precisions (repeatabilities), can be in the 20–60 meter range. The best part is that LORAN receivers can be purchased for as little as $220.

The system uses a chain of transmitters that use a frequency of 100 kHz. Virtually all transmitters use the same frequency. They occupy the same frequency by a scheme of time sharing. That is, each transmitter broadcasts a short signal at a different time than the other transmitters.

LORAN transmitters are arranged in "chains." Each station actually consists of a chain of three or more transmitters separated by several hundred kilometers. In each chain there is only one "Master" and at least two "Secondaries." At the appropriate time the Master transmits a sequence of pulses that uniquely identifies itself as a Master. At a

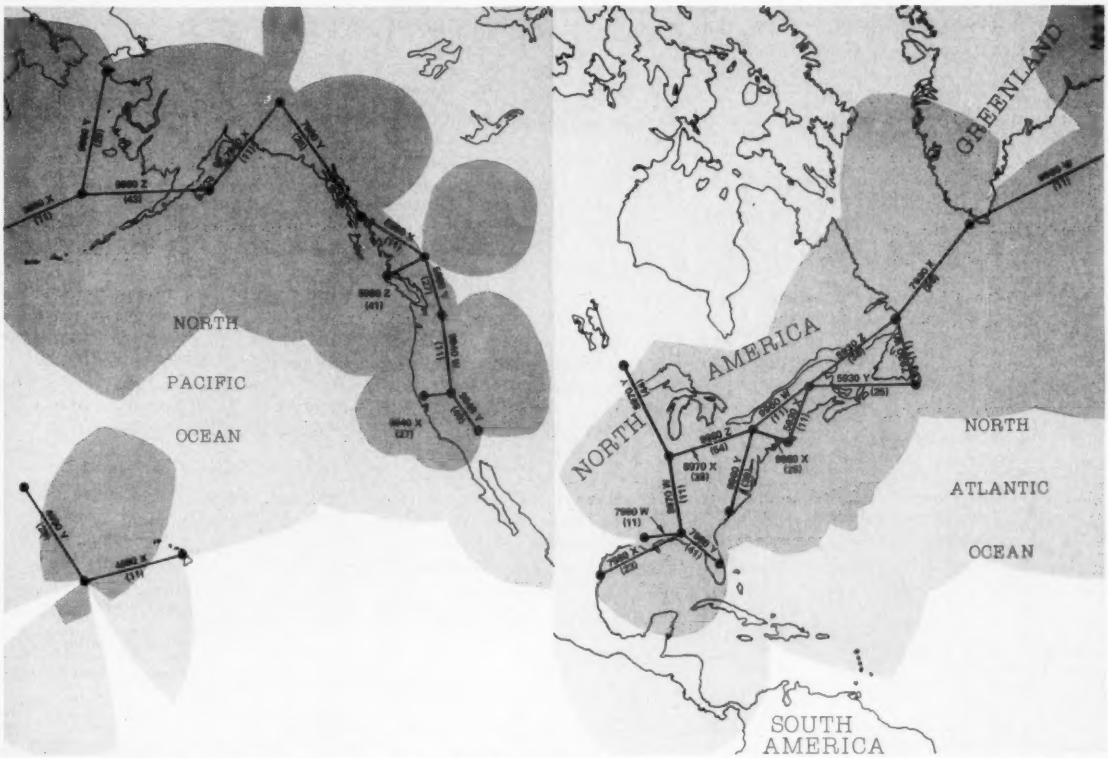

Figure 4. North American LORAN C system. Darker shaded area indicates best coverage. Lighter shading indicates conventional limits for reception. (Chart courtesy of Micrologic.)

BIBLIOGRAPHY

Ashjaee, Javad, "On Precision of GPS C/A Code," *IEEE Transactions on Aerospace and Electronic Systems Magazine*, June 1988, pp. 7–10.

Buechler, David and Michael Foss, Northrup Corp., Precision Products Division, Norwood, MA, "Integration of GPS and Strapdown Inertial Subsystems into a Single Unit," *Navigation: Journal of the Institute of Navigation*, Vol. 34, No. 2, Summer 1987.

Doherty, Richard, "Mobile Finder Banishes that Lost Feeling," *Electronic Engineering Times*, September 19, 1988.

Hunter, Tom; Wojciech Kosmalski and Phan Truong, "Vehicle Navigation Using Differential GPS," 5 pages for Ashtech, Inc.

Hunter, Tom and Jarad Ashjaee, "Land Navigation and Fleet Management With GPS, LORAN and Dead Reckoning Sensors," 7 pages for Ashtech, Inc.

Hurn, Jeff, "GPS: A Guide to the Next Utility," booklet for Trimble Navigation Inc., Sunnyvale CA 94086, 1989.

Klass, Philip J., "Defense Department Will Seek Funds to Expand NAVSTAR Constellation," *Aviation Week and Space Technology*, October 5, 1987, pp. 30–32.

Mooyman, Ken, and Cheryl A. Quirion, "High Production Kinematic GPS Surveying," Trimble Navigation Inc., Sunnyvale CA 94086.

Nordwall, Bruce D., "Civilian GPS Users Fear Pentagon's Ability to Degrade System Accuracy," *Aviation Week and Space Technology*, October 24, 1988, pp. 69–71.

Nordwall, Bruce D., "GPS Applications, Production Grow as System Gains Acceptance," *Aviation Week and Space Technology*, October 31, 1988, pp. 83–85.

Sentman, O.L. LCDR USN, "Navy Navigation Satellite System (TRANSIT)," *IEEE Transactions on Aerospace and Electronic Systems Magazine*, July 1987, pp. 25–26.

Van Wert, Jodie, "Kinematic 'Stop and Go' GPS," P.O.B. Publishing, Canton MI 1989.

"1988 Federal Radio Navigation Plan," available through the NTIS and US Government Printing Office. Publishing Numbers: DOD-4650.4 or DOT-TSC-RSPA-88-4.

Uncredited Pamphlet, "How the NAVSTAR Global Positioning System Works," published by Rockwell International-Collins Divisions, Cedar Rapids IA 52498.

Uncredited article, "Handheld GPS Navigator," *Microwaves and RF*, August 1988, p. 23.

precisely timed interval, a Secondary station transmits a similar pulse train. By precisely comparing the times of arrival of the signals, a user position can be determined. Each chain can provide coverage for about 1000 miles.

Standard LORAN Location

The LORAN-C locating system is a hyperbolic system. Each Master and Secondary within a chain transmits at precisely known intervals. If the exact time is unknown, the only known quantity is the time delay between the Master and Secondary. Since it is unknown how much of the delay is caused by the User-Master distance and how much is contributed by the User-Secondary distance, only the (unsigned) difference in the two distances can be derived. This is actually an interesting algebraic diversion. By starting with this premise, can you arrive at a hyperbolic solution?

If the exact time is known, then immediate ranges can be produced from the LORAN timing chain. This method is useful beyond the typical hyperbolic range of 1000 miles.

LOCATOR MANUFACTURERS

Magellan Systems Corp.
260 E. Huntington Dr.
Monrovia, CA 91016
1-818-359-4455
(Hand held GPS systems)

Micrologic
9610 De Soto
Chatsworth, CA 91311
1-818-998-1216
(Hand held LORAN C)

Interphase Technologies
1201 Shaf'er Road, Dept. P
Santa Cruz, CA 95060
1-408-426-2007
(Low Cost LORAN C)

However, very stable and accurate clocks are required. This would push the cost into, and perhaps beyond, the range of a GPS receiver.

The pulse string is very carefully shaped to use a minimum of bandwidth. The high-end LORAN receivers use this to their advantage. The signal may arrive at the receiver via both the ground wave and sky wave propagation. The sky wave is presumably the delayed signal. By carefully observing the start of the transmission it is possible to lock onto the ground wave before the delayed signal arrives.

The LORAN system was originally intended to provide coverage for coastal regions and the Great Lakes area. It is being expanded to cover the mid-continental gap. This is an area approximately surrounding the Rocky Mountains. The expansion is expected to be completed in the early 1990s.

The LORAN user can expect a position fix 20 to 30 times per minute. The first fix can become available within a few seconds after power-up of the receiver, to within several minutes, depending on the receiver and proximity to a transmitter chain.

Much man-made noise exists in the LORAN frequency range. In fact, the power utilities control remote facilities by modulating the power line voltage at about that frequency. This, and other noise sources prevalent in heavy urban areas can cause LORAN positioning to degrade significantly.

Direct measurements of velocity and direction are not provided by LORAN. Velocity and direction can be calculated by measuring at least two positions over a known time interval. The velocity measurement will not be as accurate as the GPS resolution of about 0.1 m/s.

Comparisons of GPS and LORAN-C

LORAN and GPS positioning are degraded for different reasons, but typically they are hurt most in the urban environment. GPS systems suffer from satellite signal loss due to shadowing. This is usually worst in an environment of tall, closely spaced buildings. The same buildings cause distortions in LORAN-C receivers. Both systems will work well in a rural environment. *[Ed. Note: Micrologic has a booklet available entitled "LORAN C Fundamentals" which provides an excellent overview of the system complete with a worldwide map of existing stations.]*

ORGANIZATIONS OF INTEREST

Wild Goose Association
P.O. Box 556
Bedford MA 01730
Attention: John Beukers, Secretary
If you have an interest in LORAN-C, an umbrella organization is the Wild Goose Association, named for the goose that unerringly navigates its way across North America, not from the famed "chase".

United States Department of Transportation
Transportation Systems Center
55 Broadway
Kendall Square
Cambridge MA 02142-1093
DOT: (617) 565–8121
TSC: (617) 494–2000
Contact: Franklin MacKenzie
Chief, National Field Office for LORAN Data Support
(617) 494–2324

Institute of Navigation
1026 16th Street NW #104
Washington D.C. 20036
Publisher of *Navigation*.

National Marine Electronics Association (NMEA
P.O. Box 130
Accord MA 02018
The NMEA-0183 standard is a typical display I/O for a LORAN receiver. Sometimes this is the only I/O built into a LORAN receiver manufactured for marine or aviation applications.

United States Coast Guard
Office of Navigation Safety
(202) 267-2267
Radio Aids Navigation Branch
(202) 267–0294
These branches of the Federal Government administer the LORAN system for the CONUS and various international waters near US protectorates.

United States Government Printing Office
Washington D.C. 20402
(202) 783–3238
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Hybrid GPS/LORAN Receivers

At least one manufacturer is building a truly hybrid GPS/LORAN receiver. The hybrid design is more than simply putting two receivers into a single box. The hybrid design takes advantage of the fact that GPS and LORAN systems suffer different types of degradation. The hybrids combine both outputs into a "best fit." At present, these are very expensive (more than $10,000). 73

Timothy G. Knauer NY9F works as a Sr. Electrical Engineer for Racotek. You can reach him at 12409 Birnamwood Ct., Burnsville MN 55337.

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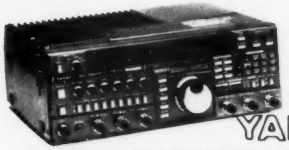

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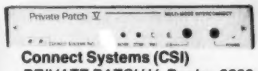

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CIRCLE 41 ON READER SERVICE CARD

Transmitter Hunting Safety

Is foxhunting a blood sport?

by Alida Jatich KA9KAG

We call ourselves foxhunters, but we don't hunt down cute, furry, unsuspecting little foxes. Real sport, to us, demands an even match between hunter and hunted. In other words, we like to outwit PEOPLE. Why do some Chicago-area transmitter hunters claim that foxhunting is a blood sport? Isn't T-hunting a matter of trekking through the terrain with DF (direction-finding) gear to find a hidden ham? If it's just a grown-up version of electronic hide-and-seek, then what could these people be talking about?

A few years back, Phil Nowak KA9KAF met with a strange accident while T-hunting. At various times in the past few years, Phil and I have participated in the foxhunts held at 8 p.m. on Saturday nights in the Chicago area. When we first began T-hunting, our equipment was an ICOM 25A resting on the dash of our old Ford, a 4-element KLM yagi attached to the roof with a big homemade wooden rack, and a handheld Little L-per DF rig, for our final approach to the fox.

Haste Makes Stitches

Hunters generally meet at the starting point at least fifteen minutes before the hour. On one occasion, as usual, we were running a little behind schedule. We were in such a hurry that we failed to tighten down all of the little straps which held the roof rack onto the car. A few minutes later, Phil was driving in the left lane of the Eisenhower Expressway at 55 miles per hour. Suddenly he saw the ICOM 25A coming off the dash . . . and then, BLAM! Phil was hit in the face by a flying radio.

I heard a loud noise and saw some blood, but it took us both a little while to figure out what had happened. The antenna and the roof rack had fallen from the car roof at highway speed. The coax attaching the antenna to the radio had yanked the radio off the dash, so that it hit Phil in the right cheek.

We were fortunate in many ways: the radio did not hit anyone in the eye, the roof rack landed safely on the shoulder of the expressway, none of the car windows were broken, and the rugged little ICOM 25A landed undamaged in the back seat of the car, although the coaxial cable had broken. The emergency room people looked at Phil a bit skeptically when he told them he had been hit by a flying radio, then they billed him $200 for three stitches.

In the Dark

Phil wasn't the only ham to end up in a T-hunting mishap. Mike Brost WA9FTS is the Chicago FM Club foxhunt coordinator. He probably has as much foxhunting experience as anyone in the area. But on one occasion, he fell down a seventy-degree embankment near some railroad tracks, resulting in a dislocated finger and an emergency room visit.

Mike says, "I didn't have my flashlight. If I'd had my flashlight, I would have seen how steep the bank was. I wouldn't have tried to walk down the embankment; I would have climbed or slid down carefully."

4x4s Can't Go Everywhere

Mike also found out that even a four-wheel drive truck is no guarantee against getting stuck. There are definitely some places you just can't go! Mike and his T-hunt partner, Tom Galetka N9CBA, tried to take a shortcut through some very old railroad tracks. Mike's 4WD got stuck at a point where two of the tracks went over a ditch. All four wheels were up in the air! Like a true foxhunter, Mike sent Tom out of the truck to find the fox on foot, and then set about trying to free the truck with the help of several other T-hunters.

When the local police stopped by, the hams talked them out of calling for an expensive tow truck. Instead, the T-hunters dismantled an old walkway made of railroad ties, using some of the ties to fill up the ditch, and using another one as a lever to move the truck. Once one of the truck's wheels was on the ground, Bill Grossman KA9GZL was able to use his van to pull Mike's truck out with a tow chain. Then they reassembled the old walkway.

This story has a happy ending . . . Tom was the first to find the fox (on foot, of course)!

Navigating Obstacles

On one occasion, when Phil and I were the foxes, we chose a hiding place not too far from an expressway. We had some misgivings about this because we knew that at least one hunter had a habit of taking shortcuts across six lanes of expressway on foot. So, when we transmitted, we announced that we would disqualify any foxhunters seen crossing the expressway on foot.

This caused somewhat of an uproar: "The fox isn't supposed to make the rules!" But we wouldn't change our minds. The spectacle of people running across a busy expressway carrying big antennas would draw the wrong sort of attention to our sport from the public and the police, especially if an accident were to happen.

Another ham in our group hurt his knee when he landed badly after jumping over a three-foot barbed wire fence. My personal opinion is that barbed wire fences are good things to stay away from. There was certainly another way to get around that fence! T-hunting doesn't have to be a risky sport. You are in control; you can definitely win T-hunts without having to do anything you consider to be unsafe.

Keep in Mind . . .

Here are some guidelines that we ourselves keep in mind on foxhunts:

1. A moving vehicle is no place for loose or improperly secured heavy objects. Install a mount for your ham rig; don't just set it on the dashboard and hope it stays put. You can get locking slide mounts that let you remove the rig when you park the car.

2. Do you use a roof rack? Inspect it to make sure it is COMPLETELY secure. If it hooks onto roof gutters, are the roof gutters coming loose? Did you tighten all of the straps? Be aware that wind loading can put stress on your roof rack. The bigger your antenna and the faster you go, the more wind loading. You wouldn't want your roof rack to home in on someone else's car!

3. In our experience, the first T-hunter to get in the vicinity of the fox is NOT necessarily the first to find the fox. So don't take foolhardy chances while driving. ALWAYS slow down before you go around a blind curve or over the crest of a hill, because you don't know what's on the other side!

4. Be careful where you put your feet and make sure your footing is secure. If you T-hunt at night, you need a bright flashlight so that you can see where you're going as you approach the fox on foot. I've seen T-hunters wearing "coal-miner" lights on their hats, leaving their hands free to work the DF gear. Long pants (even in hot weather) and sturdy shoes protect your legs and feet against thorns and other scratchy objects.

5. Remember, T-hunting is just a hobby. If you keep it in perspective, it will be safer and a lot more fun. Things go wrong when people become impatient to get somewhere. They cut corners and do things they normally wouldn't do, and it doesn't always pay off. We had a good laugh at the expense of a T-hunter in our group. He arrived at the munchies spot dripping wet and smelling rather strange. Turned out that he had swum across a highly polluted canal to get to the fox—for second place.

By the way, Mike Brost WA9FTS wants to hear from fellow foxhunters and from hams interested in foxhunting. He might be able to put you in touch with other foxhunters in your area, or help you start a foxhunting group if there isn't one already. You can write to Mike at 5127 N. Monterey Drive, Norridge IL 60656. 73

You may reach Alida Jatich KA9KAG at the Cogito Corporation, 3835 West 56th Place, Chicago IL 60629.

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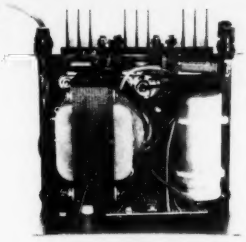

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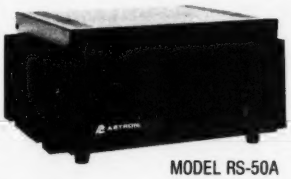

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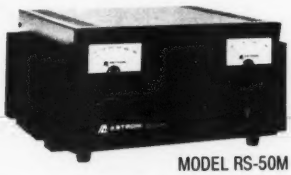
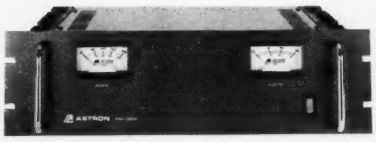


MODEL RS-50M

MODEL VS-50M

RM SERIES



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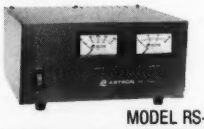
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

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VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

C-64 & 1541 12-volt Drive Conversion

Put your blown disk drive to work.

by John Neeley K6YDW

If you have a Commodore C-64 lying around gathering dust because its power supply is blown and you don't want to buy a new one, here is a solution. With a few parts, you can convert both the C-64 and 1541 disk drive to 12 volts simply and inexpensively. Also, if you are interested in emergency communications as I am, this conversion will satisfy power requirements for that portable packet station you have been wanting to build.

In a series of articles in *CTM* magazine (Jan., Feb., and March 1987), Robert Hoover KA6HZF presented a conversion of the C-64 for both AC and DC. His conversion required quite a bit of work, including rewiring, and adding a switch jack. Since I am just interested in the portability of the C-64, I modified his conversion to fit my needs. My modification only requires desoldering a few parts and minor rewiring of the power section.

Photo A. K6YDW's arrangement of the great pair—they do the job.

Taking It All Apart

To convert the C-64, you must first disassemble it. This is easy, but you must take time to ensure that you don't lose any parts, such as screws, and that you don't damage the case during reassembly.

Place a towel or piece of cardboard on your work surface, then put the C-64 keyboard down on the pad with the front of the computer towards you. Three Phillips head screws hold the case together; remove the screws and turn the keyboard back upright. Lift the front of the keyboard up, and lift off the top section. To your left, you will see the cable for the keyboard. Unplug it, and also unplug the cable for the power-on LED. Set the top section aside until reassembly.

Once you have the top cover off, you will notice either a metal or cardboard RFI shield. If the shield is metal, you have one of the older models. The newer versions use cardboard. Remove the five Phillips screws holding the shield down. Put the shield aside.

Now you can remove the circuit board from the case. To determine which version of the C-64 you have, look at Figures 1 and 2, the parts (partial) layouts of the board. The only changes you have to contend with are L5 and R100, as the others are basically in the same locations. To remove the bottom RFI shield, desolder the tabs holding the shield to the circuit board, and set it aside. Now you're ready to do the conversion.

Converting the C-64

The only components we are going to work with are L5, CR4, VR1, R37 and R100. Conveniently, the parts numbers are etched onto the board for easy identification. Locating CR4, take a marking pen and place a "dot" where the positive hole is, then desolder CR4 from the board. Next, locate VR1, desolder the pins, and remove it. The "input" pin hole is the one next to the large heat sink, or to the right of the three holes.

L5 can be in either of two different locations, depending on which version you have. On the older version, desolder the right-hand leg and lift; on the newer version, desolder the top leg and lift.

Take a look at the schematic in Figure 4. This is where we will inject a 60 Hz clock signal into the circuit. Locate the R37 and R100 pads, and the resistance will be zero, since they are common.

To rewire the board for DC conversion, which requires only three wires, take a look at Figure 5. Input from P1 (power supply) is +12V, +5V and ground. For +12V, take a wire from P1 to the positive (+) pin on CR4 that you had previously marked, and then to the pin hole of the vacant VR1 location. For +5V, take a wire from P1 to the pin hole of L5 that you had raised. Next, run a wire for ground to the ground bus of the circuit board. Drill a ¼" hole between the two game port sockets, to run your power cable through. Now, set your board aside until the next phase.

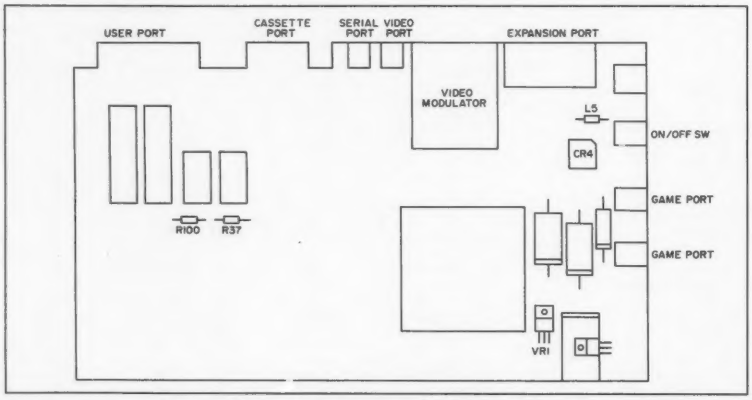

Figure 1. Old style board. The RFI shield is made of metal.

60 Hz Clock Circuit

A 60 Hz clock is required for this conversion

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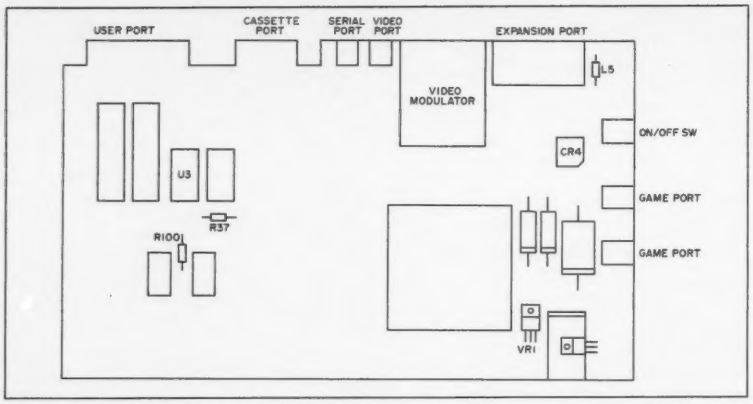


Figure 2. New style board. Notice that L5 and R100 are positioned differently. The RFI shield is made of cardboard.

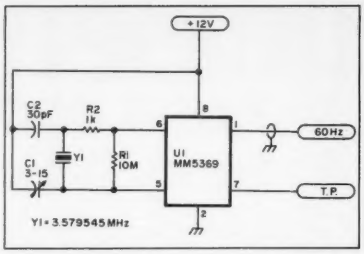


Figure 3. This 60 Hz clock drives the keyboard interrupts and other associated circuits within the computer.

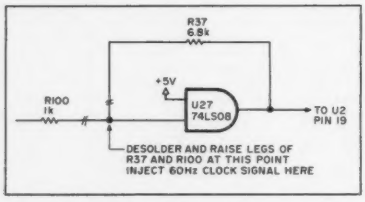


Figure 4. This circuit shows where you will inject a 60 Hz signal. A 60 Hz clock is required since you have disabled the 9 VAC line supplying the original AC power.

since you have disabled the 9 VAC line supplying the original AC power. This 60 Hz clock drives the keyboard interrupts and other circuits in the computer. See Figure 3, the schematic for a simple 60 Hz clock. Parts are available from JAMECO and others, or you can purchase a kit from Ramsey Electronics. See Table 1. I purchased my clocks from Ramsey (TB-6) for $5.50 each. They're small enough to fit inside the computer.

The schematic in Figure 3, from Mr. Hoover's article, is basically the same as the Ramsey version. After the clock module is assembled, place +12 volts on the circuit, take a frequency counter (at least seven digits), and attach it to the test point (TP). Adjust C1 to read 3.579545 MHz on the counter. This is all the adjustment required.

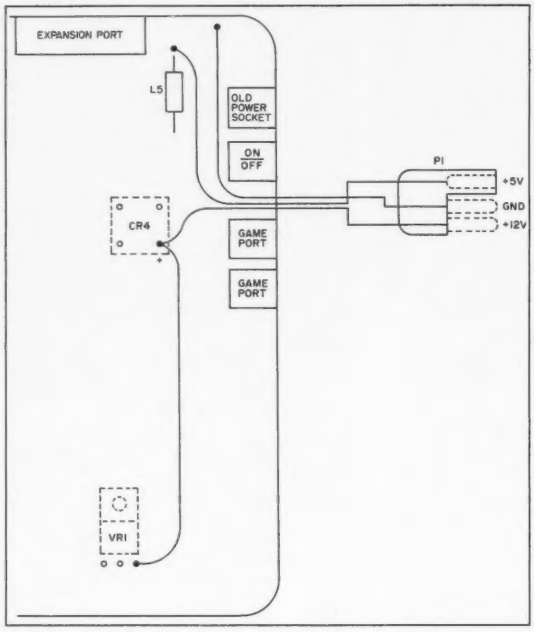


Figure 5. Rewiring the C-64 for DC conversion requires only three wires.

Use small coaxial cable (RG-174/U) from the clock module to the pin vacated by R37. To complete the rewiring, solder the +12 volt line to the new +12 volt line at CR4, and solder the ground wire from the module to the ground bus on the computer. To mount the clock module to the board, take a piece of "double-sided foam tape" and place the module behind the two serial ports, next to the video modulator. This phase completed, it's time to reassemble the computer.

Reinstallation of the Board

To reinstall the lower RFI shield, use a soldering iron to re-flow the solder tabs where they're attached to the computer board. To reinstall the upper RFI shield, reverse the disassembling process. If you have any problem with the new clock module, you can cut the upper shield to fit.

Take the bottom half of the computer and place the circuit board back in, using the Phillips screws previously removed. Reattach the keyboard cable/plug into the socket and replace the keyboard top onto the bottom section using the three Phillips screws. This completes the reassembly of the computer.

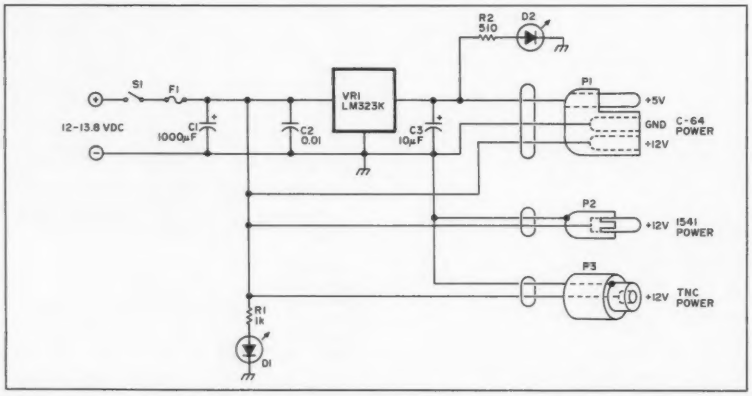
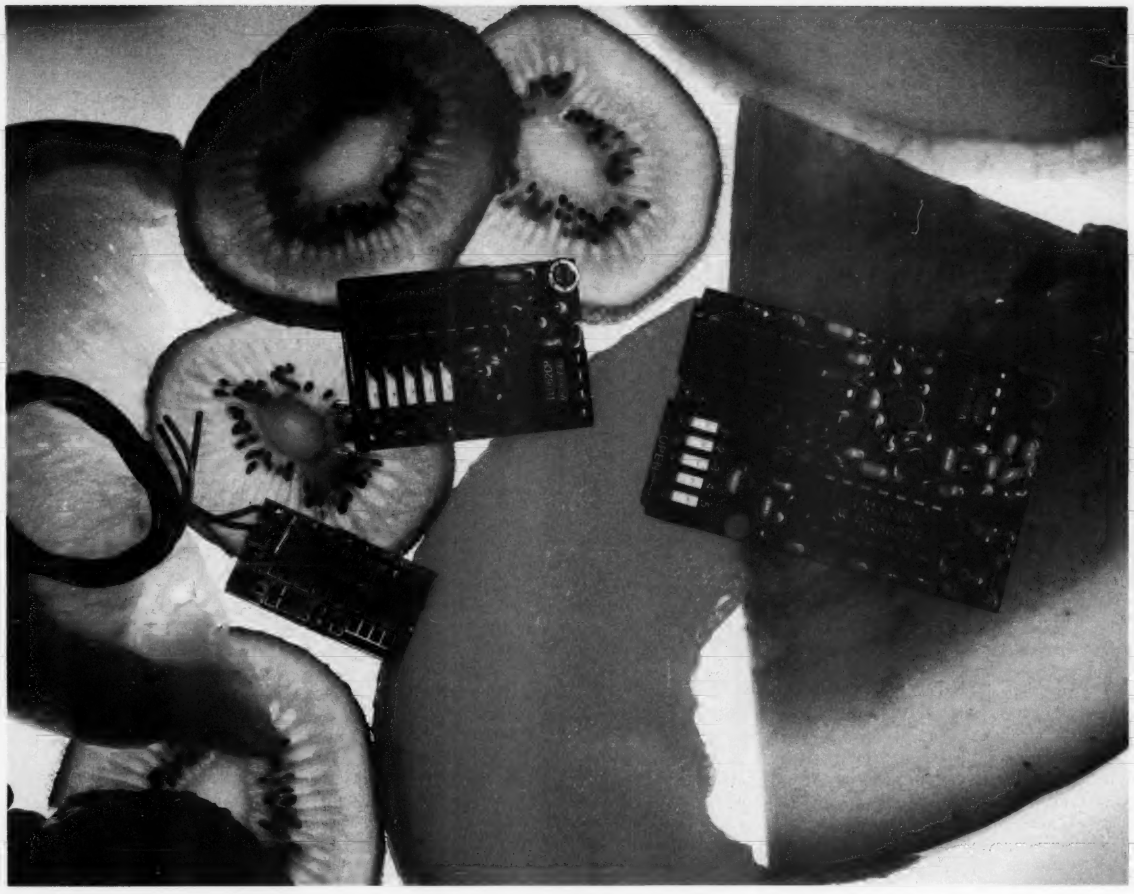


Figure 6. The modified C-64 requires both +12 and +5 volts. This simple power supply works for both the C-64 and the 1541 disk drive.

The Power Supply

The now modified C-64 requires both +12 and +5 volts. Figure 6 shows a simple power supply for both the C-64 and the 1541 disk drive. It also gives an output for your TNC. The C-64 requires approximately 1.3 amps at 5 volts, so you need a 5-volt, 3-amp regulator (LM323K). You can also use a LM309K or 7805K, but they tend to get somewhat warm, as they are rated at 1.5 amps maximum. Be sure to heat-sink this device with at least 12 square inches of heat-sink material.

Input to the power supply is from a DC source, which can be from 12 to 13.8 VDC. The circuit is very basic, so I won't go into great detail here as to its workings. Since different people prefer different plugs, I will leave that up to you. For the multi-voltage plug to the computer, I used a 4-pin Molex plug/connector; for the



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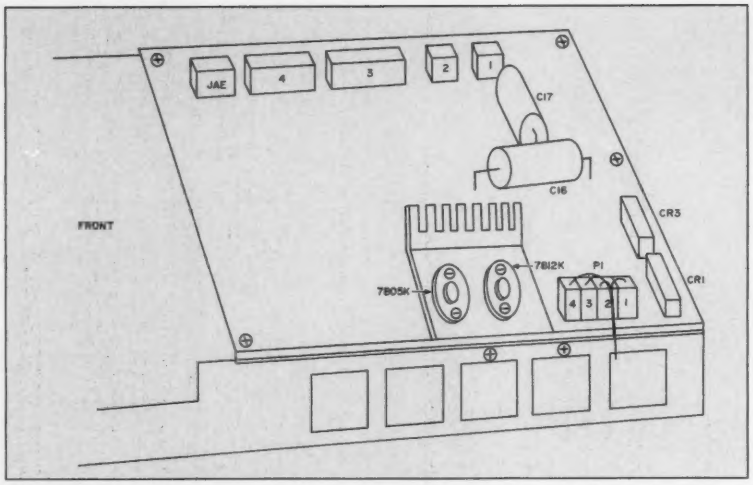

Figure 7. 1541 circuit board layout (partial). You'll remove C16, C17, CR1, CR3, the 7812K, and the AC power socket. You'll keep the 7805K, fuse holder, and power switch.

1541 disk drive, an RCA plug; and for the TNC, I used a 2.5mm coaxial plug.

1541 Disk Drive Conversion

Since my plans called for 12-volt operations only, I decided to do away with the AC supply components, which included the heavy power transformer. Just removing the power transformer lessens the weight by about 5 pounds, which is what you want if the complete system is to be portable. This conversion requires some desoldering and parts removal, along with some power circuit rewiring, a simple task which takes only a few hours.

First, remove the top cover. Use the same pad you used for the C-64 modification. Turn the drive over and remove the four Phillips screws, one on each corner. Remove the top cover and lay it aside until you're finished.

With the top cover off and the front of the drive to your left, take a look at the circuit board layout. Figure 7 shows the parts you'll work with. You need to remove C16, C17, CR1, CR3, 7812K, and the AC power socket. You will keep the 7805K, fuse holder, and power switch.

Remove the two screws on the left side of the chassis, and lift off the metal shield. With the shield removed, you can see the six connectors on the board, five along with the left-hand side and the power connector P1 on the right. Take a marking pen and mark each one with a number, as shown in Figure 7. The power connector (P1) doesn't require a number.

Remove the connectors and lay them out of the way. Take a Phillips screwdriver and remove the seven screws that hold the circuit board to the metal mounting chassis. (Don't forget the two screws on the right side, where the heat sink is attached.) Carefully lift off the circuit board and set the bottom section of the drive to the side, as we will get to it shortly.

Now that the circuit board has been removed from the chassis, we want to desolder and remove C16, C17, CR1, CR3 and the 7812K. Do this now, making sure you have cleaned out the pin holes left behind in desoldering. Once the 7812K has been removed, replace the two mounting screws back onto the heat sink, then place a wire jumper between the two pinholes (see Figure 8).

On the right-hand side of each bridge rectifier, CR1 and CR3, you will notice a plus (+) sign. Place a short wire jumper between the plus (+) pin and the next pin to the left. The modification to the circuit board is now complete.

The next phase of the modification is to remove the AC power socket and replace it with an RCA socket. First you have to remove the disk drive from the lower section of the cover. Look along each edge and you will see three screws per side. Remove these screws and lift the drive out from the bottom cover. The AC socket is held in by two small screws. Remove them and cut the leads on the socket from the transformer and fuse block.

Four leads go from the transformer to the circuit board, or P1 connector. My wires were blue and orange. Cut off the four leads at about 3" from the connector (P1).

Turn the heavy power transformer on its side, and with a large Phillips screwdriver remove the four bolts holding it to the metal frame. In the space left after the removal of the power socket, get a small piece of aluminum and cut it to fit. Drill a ¼" hole in the center for the RCA jack, and two holes for mounting the new bracket to the chassis.

To wire up the new power jack, fuse block, and switch, refer to Figure 8. On connector P1, only two of the wires are required, which means that two of the wires can be cut off flush with the connector. Leave pins 1 and 3 long, and make a "Y" splice with one leg going to the switch. Be sure to insulate the splice with heat-shrink tubing. This completes this phase of the modification.

Now, reinstall the disk drive into the lower cover using the six screws you removed earlier, then reinstall the circuit board onto the disk drive frame using the seven screws. After you have the circuit board mounted, go ahead and reconnect the six plugs. Check your wiring as you reinstall the circuit board and compare it with Figure 8.

Testing the 1541

Once you have convinced yourself that you have it wired up correctly, plug a cable (that goes to +12 volts) into the RCA jack on the rear of the drive. Turn on the power switch. If you hear loud noises, smoke, head chatter or see an LED blinking RED on the front of the drive, you have wired the circuit up incorrectly (i.e., the +12 volt lead to the +5 volt bus).

If everything checks out, turn the power off and plug in the serial cable from the C-64 to the drive. Turn on the C-64, then turn on the drive. Insert the 1541 test disk that came with the drive into the drive slot and do some diagnostic testing, along with formatting some disks and doing read/write sequences. If everything checks out OK, it's time to reinstall the metal shield and top cover. You've finished the project!

A Great Pair

I've made three conversions to both the C-64 and 1541 using the modifications in this article, and as yet I have not had one problem. The conversion is simple and straightforward, and also cheap to do. Total cost of parts for both the C-64 and 1541 conversion is no more than $15.

The C-64 and 1541 make a great pair for portable packet, even though they don't have the extras of the more expensive portable computers. They do the job, and they are available at a reasonable price. 73

Contact John D. Neeley K6YDW at P.O. Box 6672, Tahoe City CA 95730.

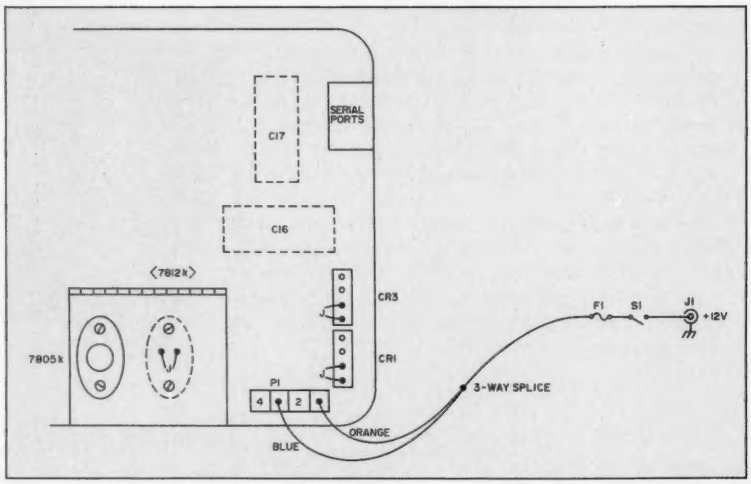

Figure 8. Time to wire up the new power jack, fuse block, and switch of the 1541 disk drive.

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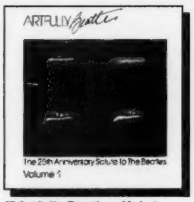

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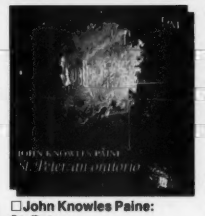

☐ **John Knowles Paine: St. Peter**
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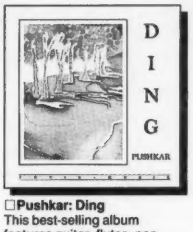
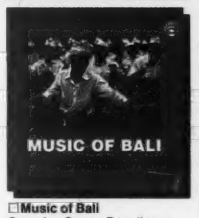


☐ **Pushkar: Ding**
This best-selling album features guitar, flutes, pan pipes, pennywhistle, bouzouki, dokodang, and synthesizer. The lightness of this music is reminiscent of an elfin dance in a sunlit forest.
AAD 42m '87 **CHV0016 $18**

WORLD



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CD Review 10/9 Apr.'90
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VARIETY

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A Return to Kit Building

A first step in helping American students rediscover ham radio.

by Dan F. Onley K4ZRA

We've got to put the FUN back into ham radio. Individual kids, and classrooms full of them, need to become involved with hands-on electronics learning and building.

Kit building used to be basic to the learning and the fun of amateur radio. Given the median age today of U.S. amateurs, it's fair to say that too many of us remember all those kits from Knight, Johnson, WRL, Olson, Eico, Ameco and others, the hundreds of Heath ham kits in all price ranges, and the many kits from the earlier years of Radio Shack's history. We LEARNED from building those kits, whether it was our first regenerative receiver, that $30-50 Novice transmitter, or our first piece of test equipment or station convenience.

Today's amateur kit situation is drastically different. The Heath lineup is high in quality but lean in variety. Most other kit sources are part of that entrepreneurial infrastructure that many see as the main hope for a resurgence of the U.S. electronics industry. Typically, kit designs are quite good, but documentation is often little more than some simple notes or photocopies of magazine articles. And the rising cost of specialized components suitable for ham designs makes it difficult for vendors to make these kits real bargains.

Rather than philosophize on the reasons for the demise of U.S. amateur radio kit building, I'd like to tell you more about a well established U.S. domestic electronics manufacturer who is serious about making a difference in the amateur radio, hobby, and school club kit building scene.

Ramsey Electronics, Inc., of greater Rochester, New York, a regular *73* advertiser and frequent hamfest exhibitor, has grown to be a major international contender in professional VHF service equipment. Their fast-selling COM-3 Service Monitor graced *73*'s front cover in August 1989.

Too often, a company that hits the big time will drop amateur or hobby products in order to maximize the profitability of new ventures and markets. The boom and bust cycles of CB and satellite TV took their toll of yesteryear's big names in ham products. Not so at Ramsey Electronics. The ham community is fortunate that the CEO at Ramsey happens to be Mr. John Ramsey himself, N2HWA/VP5JR.

For 1990 Ramsey Electronics has committed to completely revamping its line of inexpensive kits for hams, students and hobbyists, including complete step-by-step assembly manuals with well printed X-ray views of PC board layouts and detailed suggestions for enjoying—and even adapting—each kit. Whenever feasible, the assembly instructions follow the new Ramsey kit LEARN AS YOU BUILD construction philosophy. For example, the parts installation sequence for simple receivers begins at the antenna connector and follows the signal path of the schematic diagram through each stage to the audio output. Transmitter projects make sure you have the oscillator tested and running before proceeding to the buffer and further circuitry. And so on.

You have a right to know of my vested interest in all this—I am the author, and my company is the publisher, of all the new Ramsey kit documentation. We work to ensure that every single manual is written to help newcomers without needlessly offending the intelligence of experienced amateurs. I have had to build, test, use, and fully understand each kit several times in order to design each manual to be as helpful as possible. Moreover, a detailed proofreading protocol has been set up between Ramsey Electronics and my publishing company. Therefore, I believe you can look forward to building Ramsey kits of all kinds with full confidence that you're getting a good deal, that it will WORK, and that you'll learn something from the experience.

Reviewing Some Reviews

In the context of these new developments, recent reviews and articles in *73* on Ramsey products deserve a brief "review" themselves.

The SR-1 AM shortwave receiver review by WA8PYH in the August 1989 issue included a suggestion that the SR-1 could benefit from an LM386 audio stage, rather than the LM358 used in the version built by the reviewer. The current SR-1 indeed uses the LM386.

In December 1989 WBØE wrote that it would be nice if the QRP-40 transmitter were supplied with a 7.040 MHz crystal for the international QRP calling frequency, instead of the 7.150 MHz crystal that came with his kit. In fact, all Ramsey VXO transmitter crystals had already been changed to recommended QRP frequencies two months before the article appeared.

This shows that Ramsey responds to reasonable improvement suggestions. And that certainly has been my own experience in preparing the new manuals. When I found myself agreeing with WA8PYH that a BFO would make the SR-1 superhet a more interesting and useful receiver, Ramsey FAXed me the approval for a BFO in future kits, and the approval to make modification information and parts kits available to present owners.

In March 1990 N8KDD offered an article on modifying the HR-4 Direct Conversion 40 meter receiver. While the article was somewhat mistaken in its premise that some fix is needed for comfortable 40 meter operation, the author's general suggestions on varactor tuning demonstrate how easy and inexpensive it is to use a basic Ramsey PC board kit as a foundation for a fascinating variety of customized homebrew projects. N8KDD also wrote a helpful article for December 1989 on building an economical 40 watt HT-to-mobile conversion for 2 meters, designed around Ramsey's $27.50 PA-1 amplifier kit.

WBØE's review of a Ramsey QRP transmitter happily told of a confirmed QSO with a nearby western state. I'm happier yet to tell you of DOZENS of DX QSOs I've made with the QRP-30 (new) and QRP-20 transmitters, using dipoles discretely hung in the balcony of our condo unit! If you've been intrigued by Mike Bryce's regular QRP column in *73*, I think you'll find Ramsey transmitters and direct conversion receivers to be convenient and fun building blocks for setting up economical QRP stations. The spacious circuit boards give you room for modifications and improvements.

Kit Building: Bringing Back the Skills of Ham Radio

Ramsey wants you to be happy with their kit products. That's why they contracted with us to provide the best instruction books possible for inexpensive kits. They want you to be happy with past kits, too, which is why they've always had a cheerful money-back guarantee on their products.

What they **DON'T** want is to sell you factory service on a $5–35 kit! That's why both the old instruction sheets and the new manuals nag the builder relentlessly about making good solder joints. Ramsey and other equipment makers sing in unison that over 95% of all factory service involves correcting bad solder joints in kits or customer-modified gear. The 25 years on my Extra ticket served as no guarantee of state-of-the-art soldering skill, but after building, testing, and explaining in plain English scores of Ramsey PC boards, I think I'm re-earning that ticket!

Proper PC board soldering skill needn't be unique to factory workers or robots. It should be as fundamental to all hams as good CW/SSB/repeater operating practices and should be taught patiently to kids and other newcomers. Then we can begin to develop real alternatives to the $900 imported transceivers now being called "entry level" rigs—a real concern if we are serious about showing our hobby/service to young people (whose parents and siblings have their own thoughts about what to do with the family's discretionary dollars).

Imaginative, affordable kits are a vital part of the answer, both to the future of the U.S. electronics industry, and to the appeal of amateur radio to young people and folks who really have to struggle to make a living. I foresee a revival in ham radio kit building, with Ramsey's initiatives leading the way.

In sharing my enthusiasm for the Ramsey Electronics "Kit Revitalization" project, I encourage every kit vendor to give more careful attention to documentation. I'm sure we'd all like to see new Heathkits developed for hams, but I suspect that Heath would first like to see a livelier market to justify such development. I'd like to see radio equipment dealers show more respect for Heathkit equipment as trade-ins, but I'll bet they would first need to see good soldering become the norm, rather than the exception, among hams.

In any case, I'm convinced that Ramsey's fresh commitment to economical, well documented kits is very good news for amateur radio in the 1990s. I think it's encouraging that there's an accessible national source for $5 amplifier or oscillator kits, and a nice variety of functional station gear in the $25 class, from HF receivers and VXO QRP transmitters to VHF FM receivers, HF transceivers, CMOS keyer, Active Antenna, and 40 watt VHF Amplifier—plus some new surprises I'm not supposed to mention yet.

Uncle Wayne wants us to work at putting some fun back into our hobby. I'm having more fun already, now that I know I could run back to a dealer and convert my Yaesu and Kenwood gear to cash, make a deal with a collector for my treasured 1937 HRO and 1948 Collins exciter, use the proceeds to cope with realities like skyrocketing health insurance costs for small businesses . . . and still enjoy ham radio with a few dollars' worth of Ramsey kit radios. 73

Dan F. Onley K4ZRA is President of Pastoral Arts Associates of North America (PAA), which has a new school-electronics division, Discovery Resources for Radio Communication (DRRC). Licensed in 1958, he earned his Extra Class and Commercial licenses at age 19, founded several school ham clubs, and gives full credit for his teenage enjoyment of ham radio to the Elmers of his hometown of Owensboro, Kentucky, including ARRL VP George S. Wilson III W4OYI. You may contact him regarding this article and for reasonable assistance with Ramsey Electronics kit projects at 642 North Grandview Avenue, Daytona Beach FL 32118.

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73 Review

by Joe Holman KA7LDN

ICOM CT-16 Satellite Interface Unit

An easy way to change VFOs.

ICOM America, Inc.
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The ICOM CT-16 Satellite Interface Unit makes changing your uplink and downlink VFO frequencies as easy as changing a single VFO frequency. One of the most common complaints heard today among satellite operators is: "I am always playing catch-up with my uplink and downlink frequencies—I wish I could free my hands up more!" Well, you can now forget about this annoying and painful task.

The CT-16 is a small black interface unit that allows two of your ICOM x75 series rigs to communicate with each other. When enabled, the CT-16 lets you simultaneously change two separate VFO's frequencies (on the two different rigs) via one of the selected single tuning knobs on your rig. The CT-16 interface unit works well with any ICOM rig using the ICOM CI-V communication system. (All ICOM x75 series rigs use this type of communication system, except for the IC-735.)

How It Works

The CT-16 Satellite Interface Unit bidirectionally sends (serially) two ICOM x75 rigs packets of information via the interface unit. The ICOM CI-V (Communication Interface - V) System uses the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) standard.

A packet of information contains two main types of data, plus some other codes. The first main type of data is a unique number or "address" pertaining to a particular ICOM rig such as 16 for the IC-275 and 20 for the IC-475. The second main type of data contained in the information packet is a command which tells a particular rig what task to perform. The standard format of an information packet is as follows:

preamble preamble RX address TX address command frequency end of message code

Each section is one byte in length. The "preamble" tells the microprocessors that a command is arriving. The "RX address" is the rig/CT-16 address which is sending the packet of information. This is needed so that an acknowledgment can be detected with the same address in the TX address byte. The "TX address" denotes which rig is supposed to receive and process the command. Since both rigs receive all commands, commands received by the "wrong" rig can be ignored. The "command" is which command is to be executed. The "frequency" is the frequency to be set, or returned from an interrogating command. The "end of message code" tells the microprocessor that the complete packet of information has been completely sent.

The following types of CI-V commands are available:

- •set frequency
- •mode set
- •band edge read
- •frequency read
- •mode read
- •frequency set
- •VFO set
- •memory channel set
- •memory channel read
- •memory channel write to VFO
- •memory channel clear
- •scan start or stop
- •split operation

All information packets can be sent at either 300, 1200 (default), or 9600 baud.

Remember, a particular rig can only process a frequency command when its internally stored address matches the address received in an information packet. All other packets are quickly discarded by the rig's microcomputer. All addresses are factory prearranged/assigned, and will never be the same for two different rigs.

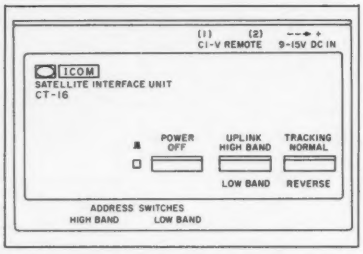

Figure 1. Ct-16 interface unit, top view.

Pre-Operation

Before depressing the power switch, which enables the interface unit, you need to set the address switches properly according to which rigs are to be controlled, select the uplink switch position, and select the tracking. (See Figure 1 for a top view of the interface unit, and Figure 2 for a front view of the interface unit's address switches.) Remember: Once depressed, the power switch enables the unit so you must make all pre-adjustments prior to switching the power on.

The address switches tell the interface unit what rigs are connected. If you select the wrong address for the right rig, the rig will not respond to any command that is sent to it. Unfortunately, the interface unit cannot notify you of this mistake, and all your efforts will soon fail when the power is turned on.

When trying out the interface unit, I connected the IC-275A and IC-475A rigs to it, setting the address switches as shown in Figure 3. The uplink switch selects which rig will be the "master" rig (usually the uplink), and which is the "slave" rig. When the interface is enabled, the master can change the slave's frequency hertz for hertz as you turn the VFO frequency dial on the master. For example, if you change the master's frequency by 5 kHz, the slave's frequency will also change by 5 kHz. Note, however, that when the uplink switch is in the high band position, the interface unit assigns the rig which operates in the higher frequency range to be the master controller. When the switch is in the low band position, the interface unit assigns the lower operable frequency rig to be the master.

But, was that previous change in frequency +5 kHz or −5 kHz? To answer that question you must examine the tracking switch. If the tracking switch is in the normal position, the

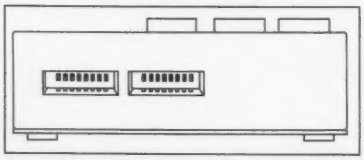

Figure 2. Address switch locations, front view.

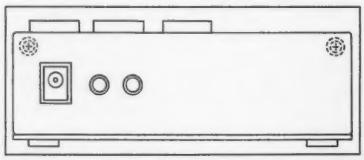

Figure 3. CT-16 (rear view).

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- Power output 15-18W (25W option) on 2M or hi-band; 15W on 220MHz; 10W on uhf or 902MHz.
- Accessory add-on PA's available with **power levels up to 100W.**
- **Five courtesy beep types**, including a pleasant multi-tone sequence.
- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
- **Reverse Autopatch**, two types: auto-answer or ring tone on the air.
- **DTMF CONTROL**: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra **4-digit owner password.**
- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- Many **built-in diagnostic** & testing functions using microprocessor.
- Color coded led's **indicate status** of all major functions.
- **Welded partitions** for exciter, pa, receiver, and controller. PEM nuts for covers.
- 3-1/2 inch aluminum rack panel, finished in eggshell white and black.
- **Auxiliary receiver input** for independent control or **cross linking repeators.**

There are many other features, too numerous to mention. Request catalog for full details.

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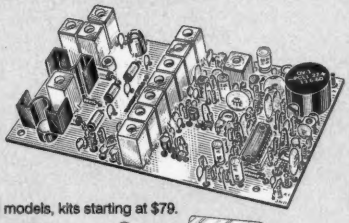
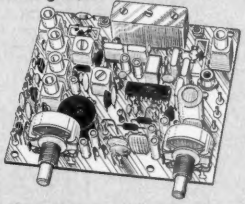


FM EXCITERS: kits $99, w/t $169. 2W continuous duty. TCXO & xtal oven options available. *FCC type accepted for com'l uhf & hi bands.*

- **TA51** for 10M, 6M, 2M, 150-174, 220MHz.
- **TA451** for uhf.
- **TA901** for 902-928MHz, 0.5W out (w/t only, $169).
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output from 10W to 100W. Several models, kits starting at $79.



FM RECEIVERS: kits $139, w/t $189.

- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift.
- **R451 UHF FM RCVR,** similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
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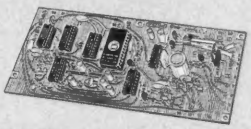
CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 ..... $59



***NEW* COR-4** kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call .. $99

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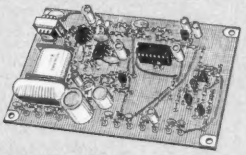
TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79



AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std . $79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiver $39

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**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-980 MHz.*

LNW-(*) MINIATURE GaAs FET PREAMP

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**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

***ONLY* $79**/kit, **$99** wired/tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

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902-928 MHz converts down to 422-448 or 430-450 range. Same price as uhf.

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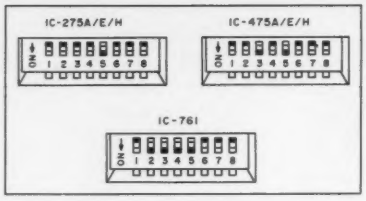

Figure 4. Transceiver address settings.

SATELLITE STATION		UPLINK FREQUENCY	DOWNLINK FREQUENCY	UPLINK SWITCH	TRACKING SWITCH
	B MODE	435 MHz	145 MHz	OUT	IN
AO-13	J MODE	145 MHz	435 MHz	IN	IN
	L MODE	1296 MHz	435 MHz	OUT	IN
RS-10	A MODE	145 MHz	29 MHz	OUT	OUT

Figure 5. Satellite frequency chart/tracking switch.

interface unit coordinates the slave to change its frequencies in the same direction as the master does (up 5 kHz on the master, up 5 kHz on the slave, and vice versa). However, if the tracking switch is in the reverse position, the interface unit changes the slave's frequency in the opposite direction than that of the master (up 5 kHz on the master, down 5 kHz on the slave).

The tracking switch is a very important switch on the interface unit. You will want to have it in the reverse position if the transponder you are working inverts its signals, such as for all of OSCAR 13's transponders. However, if you are working a satellite which does not invert its transponder signals, such as RS-10 in Mode A, you will want the tracking switch in the normal position—noninverting. Figure 4 presents some example tracking switch settings for some common satellite modes.

Tuning In (Standard Operation)

Just before switching the CT-16's power on, adjust your uplink and downlink frequencies—because, once you turn the power on, you are off and running! For proper operation, you will need to set your uplink and downlink frequencies at the upper and/or lower satellite range limits, depending upon the satellite's transponder.

If the transponder inverts signals, set the downlink frequency to the transponder's lower edge, and the uplink frequency to the transponder's upper edge. For example, on OSCAR 13 Mode B, I set the IC-275 to 145.825 MHz and the IC-475 to 435.570 MHz. Then I can switch the interface unit's power on and adjust frequencies by means of the master rig. As I turn the master rig's tuning knob counterclockwise, the IC-475's frequency decreases, and the IC-275's frequency increases! Pretty easy, and one of my hands is free!

However, if the satellite's transponder does not invert signals. set both your downlink and uplink frequencies to the transponder's lower band edge limit. On RS-10 Mode A, this means setting one rig to 145.860 and the other to 29.360. Then, switch the interface unit's power on. Now when enabled, as you increase the master's frequency by turning the master's VFO knob clockwise, the slave's frequency increases, and vice-versa for the other direction.

Blink Blink Blink

One of the features of the CT-16 I especially like involves the power indicator. Normally, the power indicator shines brightly whenever the interface unit is supplied approximately 12 volts DC. However, if you ever tune to a particular downlink frequency that correlates to an out-of-band edge uplink frequency, the power indicator blinks on and off repeatedly until you move back to an in-band frequency.

This is a real handy feature in case you do not have a frequency chart right in your hand after tuning up for the initial time. If you set the satellite's band limits before turning the power on, you will not have to look up at the chart again to find a particular set of band limits because each time you go out of band the power indicator flashes, telling you that the current frequency is out of range.

Power Requirements

The CT-16 interface unit does not require much power but it must be connected to a power source which provides some clean power between 9 and 15 volts DC. Since the majority of the unit's components are digital it does not draw much current—the interface unit only requires approximately 25 mA. Just about any standard power supply provides these ratings. The interface unit comes with a nice DC IN jack that plugs directly into the back panel of the unit.

The Final Word

The CT-16 is a great little unit and I would recommend it to anybody owning a pair of ICOMs. After setting-up the CT-16 you can pay less attention to the annoying task of continually tweaking the frequencies of your satellite uplink and downlink rigs. You can have more fun—and that's what we are all here for, isn't it?

I only found one thing that I did not like about the CT-16: the number of communication ports available. Currently, the interface unit only supports two rigs to communicate to each other simultaneously. I think it would be a great idea to have more than two ports available and to have switches to interact with different sets of rigs.

And, ah yes, the infamous Doppler shift. The interface unit cannot automatically make up the difference for the satellite's Doppler shift affected signal. This means that you have to retune your master rig's frequency to compensate for Doppler shift.

Here's a note for amateurs using the previous ICOM CI-IV communication system (IC-751, IC-751A, IC-R71A/E/D, IC-271A/E/H, IC-471A/E/H, and IC-1271A/E). The CI-IV communication system can use the CT-16 by using an ICOM designed converter, the UX-14. ICOM offers the UX-14 CI-IV/CI-V converter for about $72.50 (suggested retail price). 73

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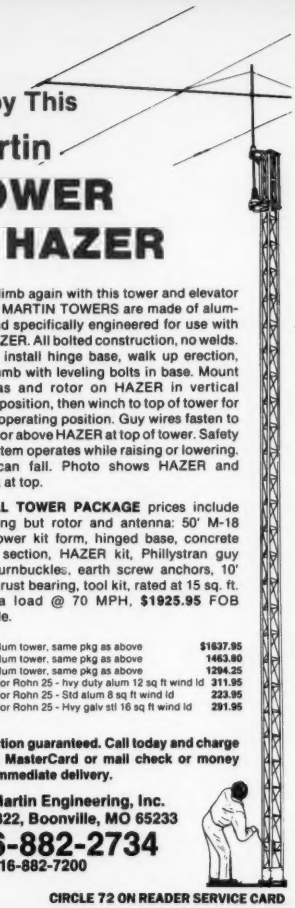

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CA-2X4M	140-155 MHz 440-460 MHz	4.5dB 7.0dB	150W	5'	MOBILE
CA-2X4SR	146 MHz 446 MHz	3.8dB 6.2dB	150W	3'4"	MOBILE
CX-902	146 MHz 446 MHz 1.2 GHz	3.0dB 6.0dB 8.4dB	150W	3'6"	BASE/REPEATER
CX-801	146 MHz 446 MHz 1.2 GHz	3.0dB 6.8dB 9.6dB	100W	3'3"	MOBILE
CA-630TN	146 MHz 446 MHz 1.2 GHz	2.15dB 2.15dB 5.5dB	150W 50W	1'5"	MOBILE

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73 Review

by Bill Clarke WA4BLC

AMERITRON Coax Switch

It makes band-hopping a snap!

AMERITRON
2375 Dorr St., Suite F
Toledo OH 43607
Tel. (419) 531–3024
Price Class: $135.

Recently, I made some major changes to my HF antenna system. As a result, I found I needed to purchase several hundred feet of new coax cable to make the run from my shack to my tower and beyond.

I checked the prices of new coax in the magazine ads and at a local supplier. Instantly, I became a victim of sticker-shock. I hadn't bought coax in several years, and I didn't realize how expensive the stuff had become. From the quoted prices, I assumed that most of it was stored at Ft. Knox with the other gold.

A Helpful Discovery

Then the AMERITRON RCS-4 Remote Coax Switch came to my rescue. By mounting the remotely controlled coax switch on my tower, I only needed a single HF feedline from the shack.

The RCS-4 is a four-position remotely controlled coax switch designed for HF use. It isn't rated for VHF/UHF use, however a conversion switch is available (RCS-8V). By operating on voltages superimposed on the coax feedline, it requires no, repeat NO, separate control cables. Controlling is done from a small console box in the station.

The RCS-4 comes in two parts: a remote relay box and a switch console. The remote relay box is designed to be tower-mounted, or at least mounted outside. It has five SO-239 connectors on it so that you can connect it to four antennas and the coax feedline.

The switch console contains an AC power supply, ON/OFF switch, and a four-position rotary control that you turn to select the antenna you wish to use. LEDs indicate the selection.

A Look Inside

Before mounting the remote relay box, I opened it up to see what it was built of. The box consists of a metal plate with mounting hardware and a heavy plastic cover. The cover-to-plate joint is sealed to keep water out. The internal circuit components are all mounted on a fiberglass PCB. The relays are multiple contact and the contact points appear hefty enough for all legal HF power limits. Soldering was neat and clean.

Because I had broken the weatherproof seal, I applied my magic sealing compound to all joint surfaces necessary to ensure watertightness. Then I reassembled the unit.

The console box houses the AC power supply, switches, and the means for placing control voltages on the feedline. The steel box is heavy enough so that it doesn't slide around on the desk. Neutral in style and color, it fit well into the scheme of things on my desk. The metal case provides 100% shielding to help prevent RFI.

Operating with the RCS-4

My antenna system consists of a full-size 75 meter loop, a half-wave vertical for 10 meters, a tribander for 10/15/20 meters, and one experimental line that always has some new concoction hanging on it. That makes a total of four feedlines, just what the RCS-4 can handle.

The switch makes the antenna changes for me, just as I desire, and it works flawlessly. There are pencil pads (places to write) on the front of the control box for labeling each switch position.

Saves Money and Time

Would I recommend the RCS-4 Remote Coax Switch to my friends? Yes, I would. The RCS-4 does its job as advertised, and by eliminating three extra feedlines, each with two coax connectors, you save money and time. It saves you money because you have to buy less coax; it saves you time because you don't have to install the coax connectors. Additionally, having only a single HF feedline cuts down on the number of holes you have to drill through the wall of your shack.

The RCS-4 is a snap to install. No extra control lines! All control voltages are superimposed on the feedline. My installation time was 30 minutes, including climbing time and sealing outdoor coax connections. A note: To use the RCS-4, you need a short patch cable from your station's output (transceiver, amplifier, tuner, or whatever) to the switch console.

The switch console makes band-hopping a snap, and the rotary selector knob turns very easily, unlike a manual coax switch. In the OFF position, the number four relay position switches to ON. I use this position as a default for my favorite antenna.

True feedline grounding is not available on the RCS-4 unless you want to use the number four position as a ground. This is not a drawback to me as I have other means of switching to ground and disconnecting my antenna system.

I could find no degradation of signals when using the RCS-4. No clicks, hums, or buzzes were heard that might be caused by the superimposed control voltages.

Though I destroyed the waterproofing when I opened up the remote relay box, I wasn't really satisfied with the original weatherproofing job anyway. I resealed it with The Welder, a product from New York Bronze Powder Co., Inc., which is available at K-Mart and most hardware stores. I also used same to seal around each SO-239. I don't like antenna system maintenance; I want things to last for years. 73

Specifications of the RCS-4

Antenna positions:	4
Loss at 30 MHz:	< 0.05 dB
VSWR:	< 1.1:1 from 1.8–30 MHz
Impedance:	50 ohms
Power limit:	1.5 kW average 2.5 kW PEP max.
Switching time:	50 ms
Power requirements:	120 VAC 50/60 Hz 220 & 440 VAC optional
Connectors:	SO-239

Bill Clarke WA4BLC can be reached at Box 2403, Falls Church VA 22042. Bill enjoys experimenting with new equipment, and he has written many reviews for *73*. He also writes books on aeronautics and aviation.

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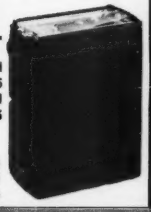

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Hamfest Shopping

The Murphy Method.

by Stu Stephens K8SJ

As a veteran hamfest dealer and shopper I have read with interest recent articles about purchasing used gear: an account of how to take another ham to Small Claims Court, and a detailed list of testing procedures for suspect gear. I offer a third alternative: The Murphy Method of Hamfest Shopping. This is a correlation of Murphy's Law ("A thing that can possibly go wrong, will.") simply stated: "All gear offered at a hamfest either doesn't work or doesn't work very well." The Murphy method is: The final sales price should take into account the cost of repair.

The Case Studies

Case Study One: the Hamburg (New York) Hamfest, ten years ago. Late the night before the hamfest, I pulled up and parked my wagon-trailer combo by a large, rollicking RV. The friendly guys invited me in for a round of brew and conversation. Part of their wares was a recent-vintage linear. Seems that at a sudden stop on the Interstate the linear, stored unsecured on a top shelf, had done a two-and-a-half-gainer dive onto the floor, an eight-foot drop. The next morning, to the question, "Does it work?", I heard the truthful reply, "Sure, the last time I plugged it in..."

Case Study Two: a different hamfest. One bemused fellow told me how he was going to trade a transceiver for a vintage transmitter: "Of course it works!" When the offered rig seemed a little light, he unscrewed the cabinet for further inspection. The power transformer was gone.

Case Study Three: the Rochester (New York) Hamfest. In the quiet evening I talked with a tube merchant, trading secrets. "Do you check them?" "No, I simply don't have the time. I guarantee to replace them, but I don't check them." True to his word, if you return the tube, you will get another, also unchecked.

Beating Murphy

We hams have a choice of being mad or being smart. Being mad is expecting perfection from the stranger sitting behind the table, strewn with eight-track tapes, his wife's Styrofoam™ Christmas ornaments, and cabinets with suspicious waterlines six inches up. Being smart is joining in the spirit of the human adventure, expecting a foxhound bargaining ritual, and never parting with more coin than would prevent you from saying, "Even though it might not work, I can fix it," with a smile.

Photo A. W8DMR and W8RVH ponder a "real bargain."

To practice the Murphy Method, I offer the following guidelines:

1. Know in advance (even carry the list with you) the retail prices of used pieces of gear. The retail stores are different; most do check the gear and offer a limited guarantee. All offer facilities to light-up the rig before you buy. The retail price is the **top** price. You know you can get the piece, guaranteed, at this price—any hamfest price should be **significantly** lower.
2. Walk away (politely) from anyone who will not bargain. Anyone hamfesting should know and abide by the rules of the game. Dickering is not only the rule, it's what makes it fun. Assume that all hamfest prices are inflated to include room to come down.
3. Any piece of gear that comes with a manual or schematic is worth an extra look. You'll need them.
4. Be on the lookout for a spare-parts junk version of the unit you want. For a few dollars you'll have a grab bag of replacement pieces, especially the mechanical parts for which there may not be a substitute. Again, you'll need them.
5. Don't underestimate the two dollar, Day-Glo spray-painted bargain. My brother bought such a Globe Scout, replaced the filter capacitors and final tube, and it fired right up. Ugliest radio on the air.

Photo B. K9RKA and KA8LWR make a discovery.

6. Don't overestimate the two dollar, Day-Glo spray-painted bargain. I bought six Novice-style CW transmitters for $40. While all of them passed the smoke test, not one of them puts out a signal.
7. On the really major purchases—the rig that will become the centerpiece of your hobby—think seriously about both your pocketbook and your frustration level. Sometimes, the mint, working bargains do come down the road. Sometimes, we need to spend the extra dollars for retail used or new gear, to get exactly what we want. Generally, we get what we pay for. Figure your enjoyment and frustration levels into the price of a radio, and shop accordingly.
8. For the more expensive, specific-interest purchases, shop the classified ads of the radio magazines and sales sheets. You'll pay a bit more, but you'll have the advantage of a name, phone number, and address. The flip side is also advisable: If you need a higher dollar for a piece of gear, don't hamfest it, but sell it through an ad.

You'll find me at Dayton every year, the guy with the plywood tables that tip if you lean on them. If you ask, "Does it work?", I will truthfully reply, "I don't know" **and**, "I have priced it accordingly." If you bargain accordingly you will have fun, pick up some nifty bargains, and lower your blood pressure by practicing the Murphy Method of Hamfest Shopping. 73

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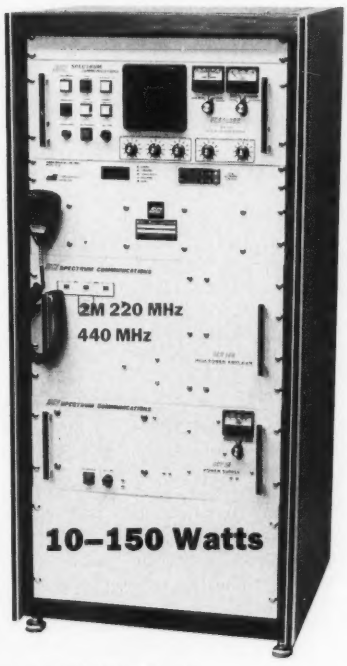

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Turnstile Antennas

A budget antenna for HF–UHF.

by John B. Dillon, M.D. KH6FMT

The turnstile is one of many useful antenna designs. I have used it as an omnidirectional antenna on 435 and 146 MHz for low-orbiting satellites. It's also good for the RS 10/11 satellites on the 10 and 15 meter bands, as well as for general use on those frequencies, and for local UHF and VHF operation. The best description on turnstile construction is in *The Satellite Experimenter's Handbook*, published by the ARRL in 1984. However, there is an error in Fig. 6-28 on page 6-21; the shields of the 50 and 92 ohm coaxes should be soldered at their point of contact.

CORIAN® by Dupont, used to line countertops and shower stalls, facilitates construction of the turnstile. It is expensive, but scraps are available. *[Ed. Note: Call 1-800-426-7426 to find your local CORIAN dealer.]* CORIAN is resistant to heat and very strong. You can saw, drill, or turn it. It is a totally satisfactory insulating material at all frequencies, at least through 435 MHz.

To make the disc, you can use a 2″ hole cutter on CORIAN that is ¼″ to 5/16″ thick (see Figure 1). The center hole is for mounting the antenna on a ¼″ wooden dowel. I used #10 house wire for the dipoles on 435 MHz and ⅛″ brazing rod for 2 meters. I have not tried the antenna on 220 MHz, but it should work satisfactorily. These antennas require a reference ground plane. On 10 and 15 meters, I use dipoles mounted on the roof, drooping at 45 degrees, without any specific reference ground.

DXing with the Turnstile

When OSCAR 12 was available, I received its beacon at the 1500 km maximum limit of acquisition as calculated on the Graftrak II program by my computer. On 10 and 15 meters I have worked both the US and Australia. The 10 meter unit would seem particularly attractive for the Novice. This works well with the new Microsats and should be an excellent choice for WEFAX reception on 137 Mhz. It has even been used to work through OSCAR 13.

These are not gain antennas, but my location here in Hawaii is ideal: thousands of miles from any large body of land, surrounded by salt water.

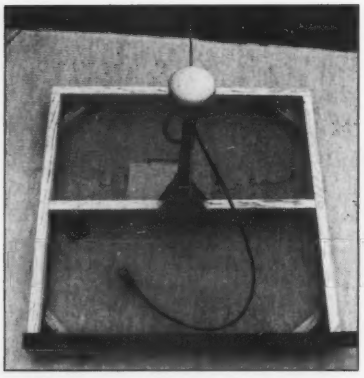

Photo A. 435 MHz turnstile antenna.

Cutting and Trimming the Coax

RG-62 (92 ohm impedance) is used as the quarter-wave delay line between the dipoles. Amateurs don't generally use this type of coax, but it is advertised by and available from most suppliers. Its velocity factor is 0.84. In Figure 2, you will find the lengths of RG-62 for the various frequencies. Trim the dipoles for best VSWR at the frequency of interest, although the antenna is moderately broadbanded. Cut the RG-62 for the center of each band. Calculate the lengths using the standard formula of 468/F(MHz).

The ground references on UHF and VHF are made with metal screening and chicken

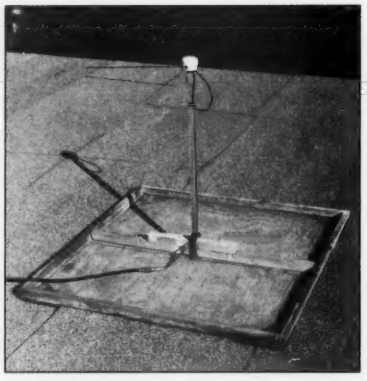

Photo B. Two meter turnstile antenna.

Photo C. Detail of the disc cover on the 10 meter unit.

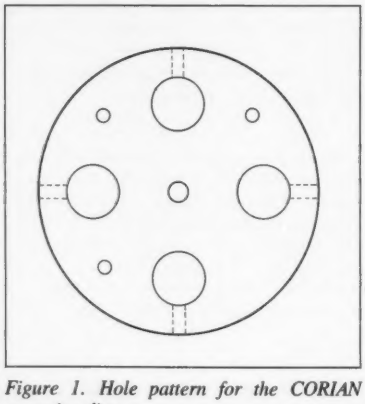

Figure 1. Hole pattern for the CORIAN mounting disc.

FREQUENCY	MATCHING SECTION	DIPOLE
435	5.4 INCHES	6.4 INCHES
220	10.72	12.76
146	16.1	19.25
28.5	82.76	98.5
21.5	109.7	130.6

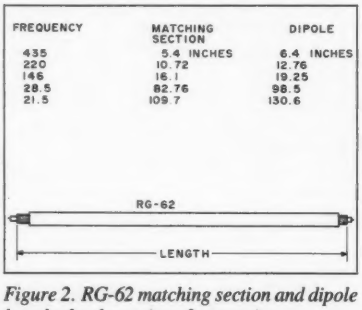

Figure 2. RG-62 matching section and dipole lengths for the various frequencies.

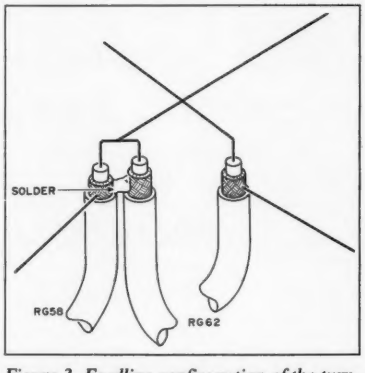

Figure 3. Feedline configuration of the turnstile.

wire. The 435 frame is 20″ square and the 2 meter is 48 inches. Thirty-six inches would be fine for 220 MHz. Experimenting, I found the distance of the dipoles from the ground planes optimal at around 3/7 of a wavelength as recommended by K2UBC. A spacing of 13-¾″ was optimum for 435 MHz and 35-½″ worked best for 2 meters.

I used a length of RG-58 from the dipole junction to the main coax. Do not use foam type RG-58, as soldering this to the elements is very unsatisfactory.

Photo A shows the completed 435 unit. I used a PVC 2″ cap over the disk for weather protection, and filled the holes with white liquid rubber. In a 2 meter antenna, the holes could be filled with epoxy cement for additional strength because of the longer dipoles. Using care, it is possible to get close to a 1:1 SWR with these units. However, to do this with a Bird meter at the junction of the RG-58 and the main line, you have to stand at least 10 feet from the UHF and VHF antennas to read the meter. Minimum SWR can be obtained with the VHF and UHF versions by slightly adjusting the element height above the ground plane. I use the meter in the shack on 10 and 15. A ground plane framework is not necessary for the 10 and 15 meter turnstiles. These dipoles are set with the 15 meter unit about four feet above the 10 meter unit on the same wooden mast, and rotated at 45 degrees. It looks somewhat like umbrella spokes or a discone. 73

You may contact John B. Dillon, M.D., KH6FMT, PO Box 759, Koloa HI 96756.

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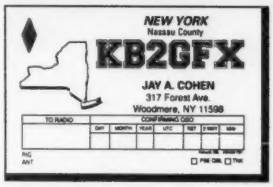

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CIRCLE 356 ON READER SERVICE CARD

PK-232 Connect Memory

Lets you know what you missed.

by William Bleher W8GQL

The packet station here in my shack is a PK-232 with Pakratt software running on an IBM clone from a hard disk drive. I hate to leave the hard disk running continuously when I'm not in the shack (wears out the bearings, you know), so I set the MTO, MFROM and DFROM parameters to REJECT ALL and the CFROM to ACCEPT ALL. Then I turn off the computer when I leave so that the PK-232 2K buffer won't fill up with miscellaneous channel talk, but will allow anyone connecting to me to leave messages in the buffer. I also do this while I am using the computer for other tasks.

Upon returning to the shack or finishing the other task, I always wonder if anyone has connected while I was busy elsewhere. The PK-232 does have a red connect LED, but it only lights up during the actual connection. It goes off when the party disconnects. I have always thought it would be nice if the unit had a connect memory and indicator that would alert me to the fact that a connection had occurred while I was gone. That way, I wouldn't have to fire up the Pakratt program just to check it out.

The simple circuit in Figure 1 provides this feature. It consists of two cross-coupled open collector NAND gates configured as a flip-flop to provide the memory function, and a steering gate driving a bi-color (red–green) LED to provide a red indication for normal connects, which turns green after the station disconnects. The circuit is built on a small perfboard mounted on bus wire stilts from two unused pads (which happend to be +5V and ground) near U12 on the PK-232 display board. The other three connections are made directly to the CON and STA LED pads. The original red CON LED is removed and replaced with the bi-color LED (Radio Shack #276-012). Thus no hole drilling or defacing of the front panel is required.

Description of circuit operation starts with power up when the 0.001 µF capacitor at IC1-5 provides a power on reset for the flip-flop by delaying the rise of the STA signal, thus making IC1-6 high (and conversely IC1-3 low), assuring that the green LED will be off. At this point, both U18-6 and IC1-8 outputs are high, and the CON LED has +5V on both ends through the 220 and 330 ohm pull-up resistors. The green element, requiring more voltage than the red, uses a 220 ohm resistor.

After the Pakratt program is loaded and the MTO, MFROM, DFROM, and CFROM parameters are set, the computer is shut down or given another task. The PKT and CMD LEDs remain lit.

A connect will pull U18-6 low, turning on the red CON LED and setting the flip-flop output IC1-3 high. The steering gate output still remains high, however, since IC1-9 went low before IC1-10 went high. When the connecting party finishes his message and disconnects, U18-6 goes high, causing the red LED to go out, and enabling the steering gate, since both inputs IC1-9 and 10 are now high. IC1-8 then goes low, turning on the green LED via the 220 ohm resistor. It will stay on until a STA signal resets the flip-flop. This will occur when the Pakratt program is again activated and a normal or UNPROTO packet is sent. I generally hit RETURN after rebooting the program, thus sending out my UNPROTO "TEST" packet, which resets the flip-flop.

U18 (7406) and IC1 (7438) are both open collector units that have 40 mA current sink capabilities and can easily handle the double currents imposed on U18-6 and IC1-8 by the dual pull-up resistors

The bi-color LED is pale white when extinguished and an orange color, compared to the PK-232's red LEDs, when lit. This leaves something to be desired, but it's a joy to come home and see the green LED on among all the red LEDs. Reminds me of Christmas. 73

William Bleher W8GQL, 18678 Negaunee, Redford MI 48240.

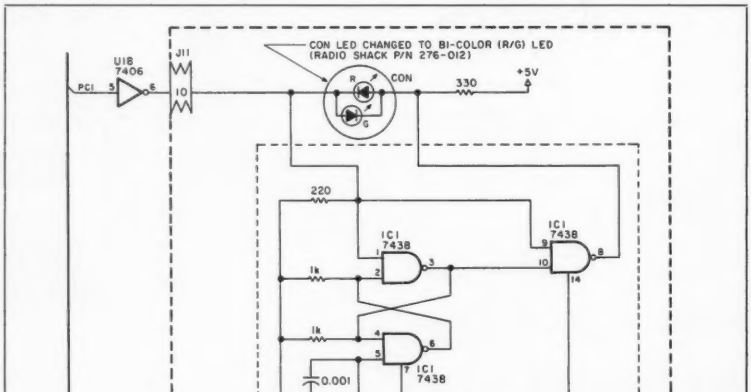

Figure 1. The PK-232 Connect Memory circuit lets you know that a connection occurred while you were gone.

Audio Patch Panel

A neat way to switch.

by David Manson N1CTI

If your shack is anything like mine, appearance is not its most redeeming value. Parts, books, magazines, and other miscellaneous objects, tend to collect on and around the operating position, attesting to the amount of time spent operating or building as opposed to cleaning.

A major cause of the cluttered appearance came to light during a recent visit to my shack by a local ham, K1GUP. He had come by for a quick demonstration of the latest and greatest RTTY program for the Radio Shack Color Computer. Incidentally, the program was from the "RTTY Loop" column of *73 Magazine*.

While trying out a newly built project, I tend to make just enough room for it somewhere on the operating table, connect it up to the rig, and put it on the air. Many of you probably do the same. It expedites testing, and besides, you'll get around to making it neat later, right?

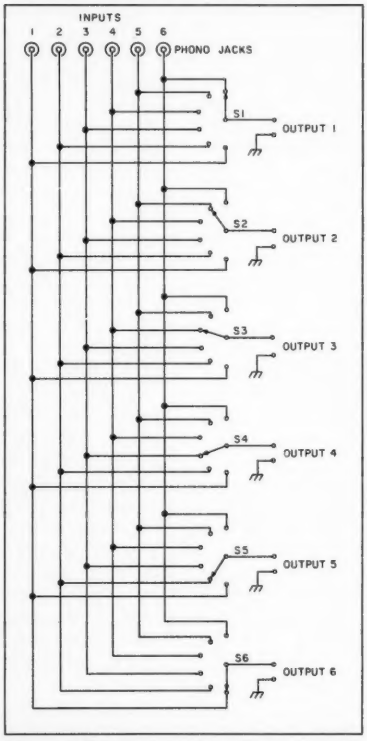

Figure 1. Schematic of the audio patch panel.

When Jerry K1GUP dropped by, I had been watching 20 meter SSTV, so I had to reconfigure the station for the RTTY demo. This simple-sounding task actually consisted of disconnecting two cables and reconnecting another two after fishing them out of their hiding places behind the rigs.

The Ideal Requirements

What I needed was a way to switch between the various sources and destinations of receive audio in my shack without having to make major renovations each time. Additional requirements were as follows:

1. The ability to send receive audio to more than one destination simultaneously (i.e., an SSTV converter and a speaker).
2. The ability to switch modes or rigs with minimal effort.
3. Nominal cost (no big ham budget required).

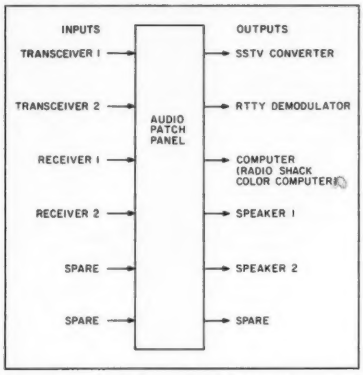

Figure 2. Block diagram, showing inputs and outputs. Phono jacks make good connectors.

Tailor-Make Your Own

This project, which meets or exceeds the above requirements, can be completed in a couple evenings, and the total cost should not exceed $25. If you don't have an extensive parts repository (junk box), you can find all the parts at Radio Shack.

In my shack I presently have four sources of receive audio and five places to send it to, as shown in Figure 2. Based on these needs and projected expansion, I elected to build the circuit with six, six-position switches (see Figure 1.).

The circuit that you build will be decided by your present and anticipated requirements. Translated, this means that the number of switches you use is equal to the number of outputs desired, and the number of positions on the switches is equal to the number of inputs desired.

Construction is straightforward. It is actually easier to build the project than to draw the schematic in the design phase. Due to wide availability, and the great variety of patch cables and adapters designed for them, I chose phono jacks for input and output connections. The ones I used are available at

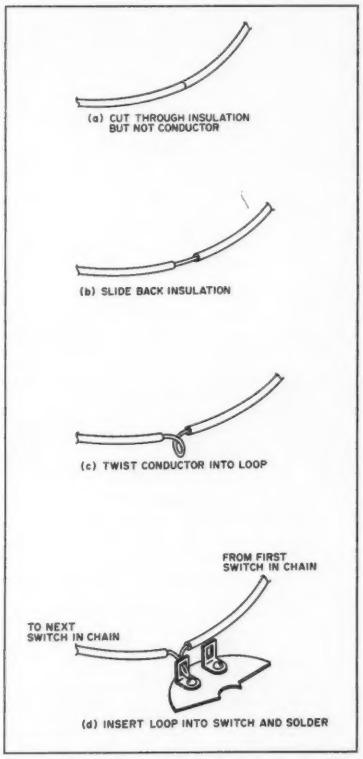
(a) CUT THROUGH INSULATION BUT NOT CONDUCTOR
(b) SLIDE BACK INSULATION
(c) TWIST CONDUCTOR INTO LOOP
FROM FIRST SWITCH IN CHAIN
TO NEXT SWITCH IN CHAIN
(d) INSERT LOOP INTO SWITCH AND SOLDER

Figure 3. Slide the insulation aside, make a loop, and insert the loop through the switch terminal lug and solder it.

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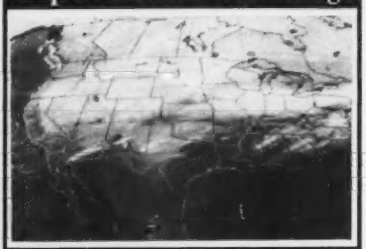

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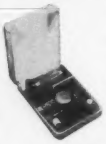

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Radio Shack, mounted in groups of two, four, or eight.

Layout is not critical, nor is the size or shape of the enclosure. However, the enclosure probably should be metal to provide shielding from RF.

The switches, Radio Shack part # RS 275-1386, have shafts about 1.5 inches long. These will have to be shortened for front panel mounting; or you can do as I did—mount the switches on an inner panel about an inch from the front panel. The mounting plate does not have to be especially rigid because when the shafts are extended through the front panel, the whole assembly becomes quite sturdy. Care must be taken in aligning the front panel holes with those of the mounting plate to prevent binding of the switches in the final assembly.

"Now I can switch from SSTV to RTTY or WEFAX with the flick of a switch."

To make wiring as easy as possible, mount the switches on the mounting plate, but do not install the plate in the enclosure at this time.

I found a shortcut while wiring my unit which saves construction time. Instead of cutting and stripping each wire for the connections between switches, I stripped the solid copper wire at the connection point, slid the insulation to both sides, and then formed a loop in the conductor which was inserted through the switch terminal lug and soldered. This procedure is illustrated in Figure 3.

Repeat the above process for each position of the switches until you have a tap for each source available at each output switch. The photo shows the layout for the switches and the construction techniques outlined above. The use of different colors of wire for each chain will greatly simplify wiring.

After the switches are wired, you can install the mounting plate in the enclosure. The input and output connectors can be installed, but be sure to tie all the shell connections together to provide a common return, as shown in Figure 1 and the photo.

Now you're ready to finish wiring by soldering a wire from the center tap of each switch to an output jack, and by connecting the switch position chains to the input jacks.

Final assembly consists of labeling the switches and phono jacks, adding knobs, and any finishing touches. My audio switching panel was built into a speaker cabinet mainly to conserve space at the operating position.

Now I can switch from SSTV to RTTY or WEFAX with the flick of a switch. I can switch rigs just as easily, with the added benefit that my shack is a lot neater with all of those audio cables out of sight behind the gear where they belong. 73

David A. Manson N1CTI, RR 3 Box 191, Newport ME 04928.

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CIRCLE 176 ON READER SERVICE CARD

73 Review *by Louis A. Smith, II N3BAH*

The AR-880 Pocket Scanner

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With the move by many agencies to the 800 MHz band, there's a natural interest in monitoring this part of the spectrum, whether you're listening to a specific agency or conducting a random search. Until recently, however, not many good receivers even covered this band, and of those that did, some only covered segments, eliminating the cellular telephone portions.

The recent introduction of scanning monitors by ACE Communications of Indiana has provided the public safety listener with a complete line of general coverage VHF/UHF AM/FM scanning receivers. These not only incorporate the traditional public service bands, but also the entire 800 MHz range as well.

New and Basic

The AR-880, newest member of the ACE family and basic model in the line, is by far one of the smallest portable scanners presently available. Its synthesized programmable receiver eliminates the need for crystals, and it covers 30–50, 138–174, 406–525, and 800–995 MHz in the FM mode, with 20 channels for frequency storage, as well as search capability. The unit's straightforward programming and lack of unnecessary bells and whistles make it easy to operate, and the under $200 price tag (factory direct) puts it well in the ballpark of other pocket programmable scanners.

Upon receiving the radio from ACE, I observed that the shipping container was very light, weighing just over a pound, and I wondered whether something had been left out (like, perhaps, the scanner itself!). After opening the package, however, I was pleased to find everything intact. The AR-880's light weight is just one of its positive characteristics.

The unit comes complete with earphone, flexible antenna, and four AAA alkaline batteries which allow immediate power-up. After attaching the antenna and putting in the batteries, you're ready to start listening! The instruction leaflet's directions are easy to understand.

The ACE AR-880, ultra-compact and lightweight.

Overall Operation

Operation is nearly identical to that of the more familiar Regency scanners. When you first turn the unit on, it's in the scan mode, and you must begin by switching to manual and programming desired frequencies into the channels via the front-mounted keyboard. You do this by keying-in the desired frequency in megahertz, followed by the two-digit channel number. You can enter any combination of frequencies at any time, and change them when you want to.

After entering the channels, you may scan them by pressing the SCAN button. You may lock out channels you're temporarily not interested in by entering their channel numbers during scanning. You may re-activate a channel by entering the number again. To monitor one particular frequency, simply press the MANUAL key until you reach the desired channel.

In order to facilitate the monitoring of repeaters or simplex systems, you can toggle the DELAY/HOLD key on and off. This four-second scan delay covers all 20 channels. With the delay off, scanning resumes less than one second after a transmission ceases.

A priority feature is also available. If a particular frequency is of primary interest, enter it into the Channel One position, which is associated with the priority monitoring mode. This mode activates a special circuit which samples Channel One every few seconds, switching to it immediately if activity is found. Toggle priority on and off by pressing the PRY key.

Search Operations

To locate new frequencies, the AR-880 searches between two user-selected limits within a band. Enter search limits by first pressing the SEARCH key.

The manufacturer's instructions mention selecting a search increment of either 5, 10, 12.5, or 25 kHz before entering the lower search range, by sequentially pressing the increment, INC, key until the display flashes the desired value at the top. However, the unit appears to assume default increments of 5 kHz between 30 and 175 MHz, and 12.5 kHz between 406 and 525 MHz. This is satisfactory since it covers all standard and nonstandard frequencies used in these bands.

For searching above 800 MHz, a unique 12.5 kHz offset is included, activated via a button on the top of the unit near the rotary ON/OFF-volume and SQUELCH controls. Pressing this button instructs the unit to search 800 MHz ranges by sampling frequencies 12.5 kHz below those displayed. Without engaging this feature, you can only search these ranges in 25 kHz increments, which could possibly result in missing some active frequencies in those areas where channel spacing in this band permits allocations "in the cracks." This control does not function on any other band.

During a search, the microprocessor-controlled, synthesized receiver passes through the frequency range in the desired increments until it finds a signal. When it locates an active frequency, the search will either remain there or resume searching after a four-second delay, depending on whether you've selected the delay or hold mode with the DELAY/HOLD key.

At any time during a search, you can switch from automatic to manual searching by pressing MANUAL. The search then stops on the present frequency. If you continue to press MANUAL or hold it down, you can step forward one increment at a time. To resume automatic searching, press SEARCH. Press SCAN to discontinue either form of search.

Specifications

Specifications for the AR-880 include sensitivity ratings of 0.4 µV on VHF, 0.5 µV on UHF, and 0.8 µV above 800 MHz. The scan rate of 20 channels per second is adequate, and audio through the 2″ internal speaker is set at a little over 100 mW. Power requirements are 6 volts DC, at about 50 mA fully squelched (no audio) and 70 mA at maximum volume with audio.

The scanner's small size and light weight makes it one of the first truly pocket-size portable scanning monitors on the market. It measures just 5″H x 2¼″W x 1-11/16″D, and weighs 16 ounces with the batteries. The flexible antenna supplied with the unit is a thin, single-element type, rather than the conventional thicker, rubberized wire-wound variety, and adds a professional touch. Below this is

the 2" internal speaker, and above is the LCD display.

On top of the unit, in addition to VOLUME, SQUELCH, etc., is a keyboard LOCK button which prevents accidental entries while mobile. It also has an earphone jack for private listening.

Field Notes

In field testing, the AR-880 proved to be easy to program and operate. All keyboard sequences are logical and easy to remember, and the large LCD display, with its convenient top-front location, is easy to read and understand. The primary display characters indicating channel number and frequency are easy to view under conditions of normal lighting. In addition to these numerics, status words, such as "Search," "Delay," "Hold," and "Scan" or "Manual," are displayed, as appropriate. The frequency increments appear in smaller characters along the top of the display, and are difficult to read at a glance, but they aren't really essential due to the pre-programmed appropriate default values.

The keyboard, located at the top of the receiver's face, is comprised of 16 gray rubber keys which contrast well with the black case. They function flawlessly; they do not "bounce" (i.e., unintentionally repeat characters when pressed once) as occurs on some programmable scanners, and they do not give a positive "click" when pressed or emit a "beep" to confirm keyboard entries. This latter omission is welcome, as the annoying "beep, beep" which accompanies other monitors is embarrassing when you want to use them discreetly.

The pre-programmed decimal point for all frequencies above 50 MHz is another nice keyboard feature. If you're entering 453.450 MHz into Channel 15, you would keyboard: 45345, ENTER, 15. The microprocessor would assume your entry to be above 50 MHz and record the entry as 453.45 MHz. For frequencies between 30–50 MHz, however, it is necessary to use a decimal point. If you attempt to enter a frequency outside of the previously listed bands, an error message appears.

The RESET button is on the lower right of the keyboard, recessed behind the front panel and accessed through a small hole. If you want to erase all frequencies from both the scan and search memories, use the point of a pen to press this button.

The ON/OFF-volume and SQUELCH rotary controls operate smoothly, as do the KEYBOARD LOCK and −12.5 kHz OFFSET buttons. The BNC antenna connector conveniently allows quick connection to an external antenna when you're driving.

The battery compartment, concealed by a sliding cover, is located on the lower half of the back side of the radio. Inside the snug compartment, the four AAA batteries fit in a holder which can can also contain NiCd batteries. If you want to use ACE's optional NiCd pack, you can remove the holder to make room for it. The AR-880 can also accommodate an external power source via a sub-miniature coax jack on the left side panel. This jack will accept the ACE charger/AC adapter or other 6 volt DC power source.

The belt carrying-clip is a single piece of metal secured to the rear panel by two screws. The clip holds the scanner securely in place, and with the scanner's light weight, you even forget it's there! Or, if you prefer to carry the AR-880 in your pocket or in the optional leather carrying case, you can easily remove the clip.

The AR-880's sensitivity and selectivity on VHF proved close to the spec ratings and were average for a pocket scanner. The unit's performance on UHF, however, was outstanding! The AR-880's short flexible antenna easily received signals from stations more than 50 miles away, over mountainous terrain. The only disturbing occurrence on UHF was the near total annihilation of 470–471 MHz by internal "birdie" signals. Otherwise, the major public safety subbands of 453–454 and 460–460.600 MHz were interference-free. Several birdies just below 461 and 462 MHz hindered business monitoring in 460.6–465.0 MHz.

"The unit's performance on UHF, however, was outstanding!"

The unit also received the 800–950 MHz band with exceptional sensitivity and freedom from interference. Signals were loud and clear, and produced good audio when received dead-on frequency. I encountered relatively few birdies considering the width of this range. The search rate was good when I tracked through newly-found trunked systems. In segments of the band where channel spacing is 30 kHz, however, the disparities in channel spacing (from the receiver stepping in increments of 12.5, or 25 kHz when the allocations are every 30 kHz) sometimes caused the receiver to be 5 to 10 kHz off the actual transmit frequency. This made the audio sound tinny. These disparities can render certain frequencies unmonitorable when the receiver is 10 kHz off.

The Offset Feature

The 12.5 kHz OFFSET button received business and public safety frequencies in this band, but it wasn't intended to remedy the 30 kHz spacing problem, and it didn't. Technically, this control deducts the offset from the displayed frequency, so you have to mentally subtract it to know the actual frequency. The usual search increment in this band is 25 kHz, which is not altered when you use the offset. However, remember (especially when you're searching the 800 MHz spectrum or programming frequencies in this band) that instead of checking the displayed frequencies, the receiver is actually listening 12.5 kHz below. Therefore, you will not be covering twice as many frequencies in a search when the −12.5 kHz offset is on; rather, you will only be covering frequencies which fall in between those usually covered by a search without the offset.

Turning the offset on while scanning can result in some interesting situations. For example, what does a listener do when, among the 20 scanning channels he has programmed, some 800 MHz frequencies require the offset and others do not? It would seem practical to receive one group or the other, but not both at the same time. But you cannot program the synthesizer individually to receive and display the actual offset frequency. This could be a problem if you're going to use the AR-880 where splinter channel assignments are used alongside normal allocations.

Minor Shortcomings

The AR-880 does not have a light to illuminate the LCD display, which renders night use impossible without another source of light. The manufacturer explained that the omission of a light helps conserve minimal battery power in such a small unit.

I noted several other minor difficulties. The instruction leaflet provides sufficient information for the experienced scanner user, but it's short on details helpful to a beginner. Also, there is a lack of accurate information as to which search increment would be best to use on each band. ACE supplements the instructions with an information sheet, but it is badly in need of correction. For example, it suggests using 12.5 kHz search increments on VHF high, and states that it's lawful for amateur radio licensees to monitor cellular telephone communications. Several references to AM capability and the aeronautical band need to be eliminated, as they are carryovers from a manual for another scanner in the ACE line.

The alkaline batteries which come with the unit are good at first, but with heavy use they can be quickly depleted, making operation expensive. A better solution is to purchase NiCd batteries from a local radio shop, or the NiCd pack directly from ACE. An internal NiCd pack and charger/adapter as standard equipment would be a welcome addition.

A Contender in the Market

Despite several shortcomings, the AR-880 by ACE Communications is definitely a contender in the pocket scanner market. With its ultra-compact size, complete coverage of 800–950 MHz, good sensitivity, and under-$200 price tag, it certainly is a welcome addition to the field of pocket scanners. It's worth consideration by any hobbyist intent on listening to the world above 800 MHz.

You may contact Louis A. Smith II N3BAH at R.D.#6 Box 479, Latrobe PA 15650-9053.

ATV

Ham Television

Bill Brown WB8ELK
% 73 Magazine
Forest Road
Hancock NH 03449

Summer Fun

Just because Summer is here, don't assume that ATV activity takes a back seat to outdoor fun. Some of the best DX openings occur during June, July and August. Temperature inversions can occur regularly this time of year, particularly during the late evening hours and just before sunrise. Expect to see some 200–400+-mile openings occur in the Midwest and East Coast. If you live in a major metropolitan area you can actually use those nasty, smoggy days to your advantage. A thick smog layer is a good tipoff that a healthy inversion layer is present. ATVers in Los Angeles have made 100-mile contacts on the 1200 MHz band using less than 10 milliwatts during a Smog Alert.

Summer is a good time for mountain-topping expeditions. A small portable ATV station and small beam can net you some amazing results. Chuck WB9IHS plans an expedition to the top of 6,900-foot Mt. Mitchell, North Carolina, this May. Don K4SAO and KC4CTW operated from nearby Mt. Roan last year making some 350-mile contacts with the aid of an early morning enhancement. Try and coordinate with another group to attempt a mountain-to-mountain contact. Rod WB9KMO operated from 9,000-foot Mt. Pinos during the UHF contest in 1981. I drove up to a 5,500-foot peak near the entrance of Yosemite. Even though we were 200 miles apart I could see an excellent picture using just a quarter-wave whip attached to my TV. Needless to say, he was P-5 with my tripod mounted beam. During this coming Field Day, Cal WA1WOK will be operating ATV from 6,600-foot Mt. Washington, the highest point in New England, which should net him contacts over a several-state area.

Those of you in the flatlands of the Midwest shouldn't despair! Summer is the perfect time to convince any pilot friends to give you and your ATV system a ride. Create your own mountains and band openings! Just attach a magmount to the landing gear (use furnace tape to secure it) and prepare to make some 100-mile or more contacts. Bring along a video recorder and try operating as a "delay-action" ATV repeater. This is a great way to hook up isolated groups who normally don't work each other.

An EAA (Experimental Aircraft Association) meeting or fly-in is a good place to meet pilots who may be interested in taking you aloft. Bring along a portable ATV system and a TV set. Offer to provide live video from the cockpit of one of these experimental crafts to the TV set in the hangar so that everyone can "fly along." You'll probably have several pilots waiting in line to take you up. Jeff KA8WLV visited one of these fly-ins and ended up televising a very exciting flight from the back seat of a restored WW II fighter. They even simulated a dogfight as well as some hair-raising "strafing" runs. The crowd in the hangar loved the show and asked lots of questions about ATV and amateur radio.

Try attending a hot-air balloon exhibition. Shouldn't take much arm twisting to convince one of the balloonists to take your ATV station along. . . and of course someone to operate it! Not only will you get the ride of a lifetime, you'll provide your local ATV group with a real thrill. Earl KS8J and Tommy N7KBO of the Phoenix AAA5 club took this idea one step further and held their marriage ceremony aboard a hot-air balloon, while transmitting the event via ATV down to the crowd below!

Photo A. Computer screens transmitted from the "FOX" (ATCO Foxhunt).

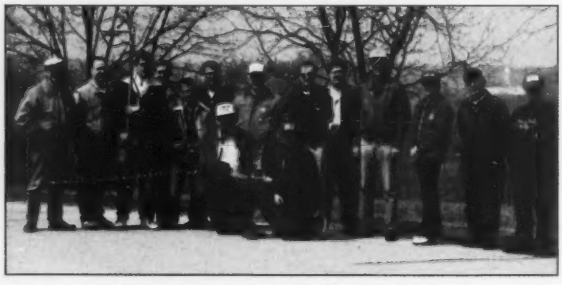


Photo B. BRATS ATV Foxhunt (Davenport, Iowa).

ATV Foxhunt

There's nothing like a foxhunt to get the locals together for a little friendly competition. Several ATV groups have decided to add a new dimension to foxhunting. . . the Video Foxhunt. Armed with nothing more than TV sets and a variety of mobile directional antennas the ATCO group (Amateur Television of Central Ohio) positioned themselves around Franklin county for their first hunt in the fall of 1988. The hidden transmitter powered up with 50 watts on 439.25 MHz, with a computer screen depicting a "Fox." They used high power for just one minute to allow distant stations to get their initial bearing. Then they dropped power to 2 watts for the duration of the chase. It's always fun to see the lenghths an ATVer will go through to build up his "secret weapon" mobile tracking station. Dick W8RVH definitely got a number of stares from passers-by when he would periodically raise his beam on the side of the freeway on top of a 15-foot pole! KB8UU had a long yagi fixed in the bed of his pickup truck. This setup was very effective but required a large parking lot to rotate his antenna. The winner of the day was Bill W8DMR with his PVC loop antenna suction-cupped to the side of his car door. This turned out to be quite a social event with a huge potluck dinner. . . however, to join in the feast you had to find it!! Where did the wily fox hide??? Where else but at a Cable TV site surrounded by satellite dishes! A number of trackers drove by the site since they thought it was too obvious a place to hide.

The BRATS group (Big River ATV Society) of Davenport, Iowa, has a number of successful foxhunts to their credit. This year six vehicles with two or more "hunters" met at St. Ambrose College to chase out after the "rabbits." The rabbits were Matt NØGIK and Phil N9ZK, the winners of last year's hunt. The "rabbits" hid out in the parking lot of the Illinois State Police in East Moline. Matt and Phil used a 10 watt transmitter and the high location provided a good signal for the "hunters" to track down. First place was awarded to the team with the best time and mileage. This year's winners were WBØFBP, WDØAMA and WBØSBL arriving in 38 minutes after driving 20.9 miles. Second place went to WBØBIZ and WBØOLX. Over 18 amateurs joined in this event for their largest foxhunt yet!

Walk-a-Thon ATV

The Western Vision ATV group of Denver decided to add video coverage to help out with the Super Cities Walk for MS. Five portable checkpoints were set up along the route, with Dave W6OAL and YL Margie acting as roving mobile. Using 144.34 MHz as coor-

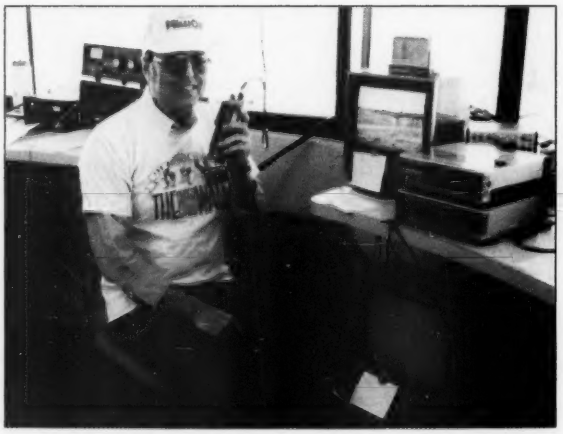


Photo C. WBØTUB manning Mission Control (Super Cities walk-a-thon).

Photo D. W6OAL roving mobile (Super Cities walk-a-thon).

dination frequency, Tim WBØTUB, Steve NV9O and Sue Hoffman, located at mission control, were able to request video from each of the checkpoints. Video was P-5 from all checkpoints including some great shots from the roving mobile. The walk-a-thon officials were quite impressed with the coverage.

Members of the Western Vision group will also be participating in a unique way to aid the National Weather Service and SKYWARN during severe weather. Several mobile ATV stations have been put together to act as weather spotters. The mobiles will actually be able to send back live video of the severe weather direct to the SKYWARN center via a link to the ATV repeater on top of 7,400-foot Lookout Mountain. In addition, NØHMV in Loveland (70 miles away) and NØHZY in Denver have tower-mounted cameras available for weather coverage in their areas. Also Oliver NØJBK can provide a camera view from the roof of his building in Englewood when needed. The Lookout Mountain repeater has an input on 426.25 MHz with an additional input soon to be on 1277.25 MHz. The output is on 1253.25 MHz and provides coverage to the greater Denver area. If you're in the area, give the Western Vision group a call on 144.34 MHz. They have an activity night every Monday night at 8 p.m.; they can also be found each Thursday night at 7 p.m. on the 147.225 (-600) repeater. *(Thanks to Oliver NØJBK and Sharon NØJBG for this information.)*

Recently ATVers in Albany, New York, participated in a campus run around the SUNY-Albany campus. Several portable stations were set up to cover the event. Their next endeavor will be to provide coverage for a regatta on the Hudson river. If you're in the Albany area give the ATV group a call on 146.49 simplex or via the K2CBA repeater on 145.31 (−600). Thanks to W2MTE and K2CBA for information.

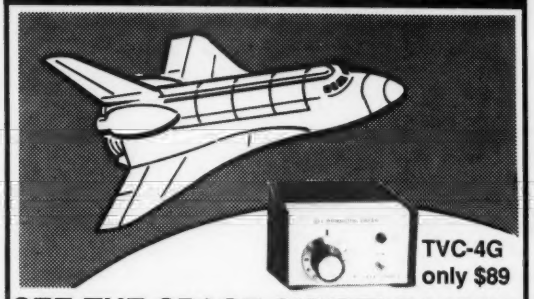
Summer Balloon Launches!

Keep looking to the sky this summer. If all goes well there will be a balloon launched each week starting June 30th. Each balloon will have an ATV transmitter and a two meter beacon for tracking as well. Coverage range should be around 400 miles from launch point.

- June 30, 9 a.m.—WB8ELK "live camera" flight launched from *73* headquarters in Hancock NH. ATV: 439.25 MHz; FM: 144.34 MHz; HF net: 7.155 MHz.
- July 7, 10 a.m. CDT—KDØFW "live camera" launched from east of Kansas City MO. 3 watts ATV: 439.25 MHz; FM: 144.34 MHz & 52.525 MHz; HF net: 7.232 MHz.
- July 14 (alternate dates:July 15 and July 21), 1300 UTC—K4BV "Sky Beacon one" balloon from The Crystal River, Florida airport. Alternate launch site is Inverness, Florida. ATV: 434 MHz (vertical); FM: 144.34 MHz; HF net: 7.155 MHz. Contact John Bayne N4EEB, 7 Castle Manor Dr., Ormond Beach FL 32174 for more details.
- July 21, 9 a.m. CDT—NJ9Y launch from Champaign IL. ATV on 439.25 MHz (horizontal), 144.340 MHz (vertical); 28 MHz band CW transmitter; HF net: 7.155 MHz.
- Date and time to be announced —WØRPK & WB8ELK/KA8TEF/KA8LWR dual balloon packet digipeater experiment. Two balloons to be flown at the same time from Des Moines, Iowa, and Bucyrus, Ohio (600 miles apart). After reaching 50,000 feet packet stations will be able to link through both balloons for coverage of a large part of the Midwest.

All balloon launches & special events will be announced via the ATV net on 3.871 MHz each Tuesday night at 8 p.m. EDT, the AMSAT net on 3.840 MHz (Tuesday at 9 p.m. EDT & CDT, 8 p.m. PDT), as well as on your local packet BBS. Also, we've started an ATV SIG on the *73* phone-line BBS. Dial in on (603) 525-4438 for up-to-the-minute details. This is an open forum for anyone with questions or announcements concerning ATV. Stay tuned... 73

AMATEUR TELEVISION



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±600Khz @ 145 Mhz: 28db
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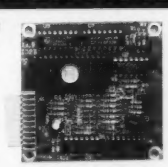

NEW Model ID-2B

The ID-2B provides required station identification without troublesome diode programming. The "ID over voice inhibit" circuitry allows for courteous operation by not allowing an ID until the next squelch closing.

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Andy MacAllister WA5ZIB
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More Hamsats on the Way

As if 10 operational amateur satellites weren't enough, more are expected very soon. The September 1989 column detailed a proposed frequency plan for RS-12/13. Those 10, 15 and 2 meter frequencies have been confirmed by letter from Andy RS3A at the RS control center in Moscow (see Photo A). The launch date of RS-12/13 is still in question—it could be any time this year.

Activity on the RS-10 Mode A transponder (2 meters up and 10 meters down) continues, but it has been a while since the Mode T unit (15 meters up and 2 meters down) has been active. When RS-12/13 is launched, we hope its Mode T system will be activated regularly. Signals from Mode T on 2 meters come through very well. And there's more.

MIR Activity

Photo B shows a QSL received for a contact with U2MIR on the Soviet Space Station *MIR*. The current crew has not had much time for amateur radio activity, but more is anticipated. If you have made a contact with any of the cosmonauts, QSL via UW3AX. Boris has been responding directly to those who include a self-addressed envelope and IRCs. Frequencies to watch for *MIR* activity include 145.500 and 145.550 MHz FM simplex.

RS-14

RS-14 has been scheduled for a June 1990 launch from the Plesetsk launch facility located 800 km north of Moscow. Like RS-10/11 and RS-12/13, this amateur payload is a part of a larger satellite. RS-14 is attached to GEOS, a Russian geological research satellite. The proposed orbit is circular and 1000 kilometers up with a period of 105 minutes.

The January 1990 column briefly outlined some of the satellite's capabilities. More information is available now that the launch is imminent. See the tables for details. The amateur radio equipment includes two analog transponders, both using Mode B (70 cm up and two meters down), and the West German RUDAK 2 package.

Satellite enthusiasts who operated in the mid-seventies fondly remember the quality of Mode B analog communications on the low-orbit AMSAT-OSCAR 7. AMSAT V.P. of Engineering, Jan King W3GEY, performed tests via the B transponder on A-O-7 over 15 years ago and determined that signals as low as 120 mW ERP (effective radiated power) could be heard through the satellite.

The success of Mode B on A-O-7 inspired Mode B operation on the Phase 3 high-orbit satellites (AMSAT-OSCARs 10 and 13) as the main transponder configuration. The analog receiver on RS-14 is expected to be as good as or better than A-O-7, while the transmitter is capable of 10 watts output. Omnidirectional antennas and low power (10 watts ERP on the uplink) are expected to be sufficient for easy Mode-B work with the RS-14 analog system.

During early 1989, Peter DB2OS and Leo UA3CR had many intensive discussions concerning a joint effort between the RUDAK group in Munich, the AMSAT-U-ORBITA group in Molodetchno near Minsk, and the Adventure Club in Moscow for the design and construction of an amateur satellite. A contract was signed in Surrey, England in the summer of 1989 by Dr. Karl Meinzer DJ4ZC (designer of A-O-7's Mode B transponder), Hanspeter Kuhlen DK1YQ, and Leonid Labutin UA3CR, for the start of a venture known as the RUDAK-2/RADIO-M1 project. Due to amazing efforts on the part of the RUDAK group, the complete digital satellite package was built and presented to representatives of AMSAT-U-ORBITA in Munich on January 21, 1990. Final integration and testing was completed a week later in Molodetchno in the Soviet Union.

RUDAK stands for Regenerative Transponder for Digital Amateur Radio Communications and is basically a complex multispeed packet radio store-and-forward system. Stations equipped for operation via the microsats will be able to connect to and through the RUDAK system on RS-14, at least via the 1200 bps uplink. Note (in the table) the different data speeds and modes that are supported. Uplinks range from 1200 to 9600 bps and downlinks from 400 to 9600, with digitally-created speech as an option. Beacon digital telemetry (30 parameters) *is* 1100 bps PSK; this is not an error. RS-14 promises to be an exciting hamsat addition.

PSK and the MicroSats

Last month's column described the different PSK (phase-shift keying) modems by TAPR (Tucson Amateur Packet Radio Corporation), G3RUH and PacComm. The May column showed the TAPR unit while a version of the G3RUH design was presented in June. This month, Photo C depicts the

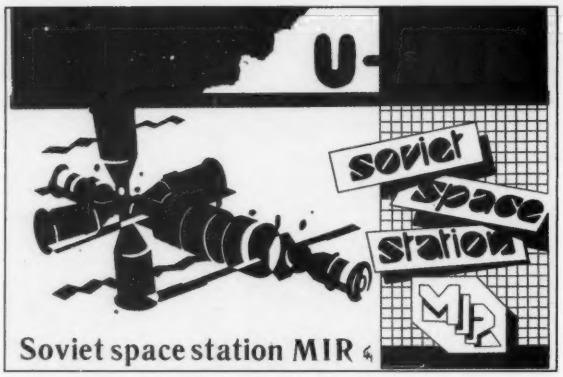

Photo B. QSL card for a QSO with the Soviet Space Station MIR.

RADIO-M1/RUDAK-2 Data Sheet
AMSAT-DL/AMSAT-U Joint Project

RUDAK II (2nd generation) is a part of the Russian amateur radio transponder "RADIO-M1." "M" refers to Molodechno, White Russia, USSR. RUDAK is the German abbreviation for "Regenerative Transponder for Digital Amateur Radio Communications." The transponder is a joint project of AMSAT-U-ORBITA in Molodechno, the Adventure Club in Moscow, and AMSAT-DL/RUDAK group in Marburg, Munich and Hanover.

Launch: June 1990 from Plesetsk, USSR with PROTON rocket.
Satellite: "Subtenant" to GEOS, a Russian geological research satellite.
Orbit: Circular orbit at 1000 km altitude and 83 degrees inclination. Orbital period is 105 minutes.
Total power consumption: 40 watts maximum.
Total mass: 22 kg
Total dimensions: 480 x 400 x 300 mm
Amateur Radio Payload: Linear and Regenerative Transponders for analog and digital communications and telemetry beacons.

Photo A. Andy RS3A at Soviet RS satellite command station.

Photo C. The "plug-and-go" PacComm PSK modem. (Photo by Walter Holmes WD5GAZ.)

Linear Transponder 1

Uplink: 435.102–435.022 MHz (80 kHz)
Downlink: 145.852–145.932 MHz (inverted)

Output power: 10 watts maximum.
Beacon CW telemetry (8 parameters): 145.822 MHz, 0.2 watts
Beacon digital telemetry (30 parameters): 1100 bps PSK
R+Scrambler 2 kHz deviation: 145.952 MHz, 0.4 watts

Linear Transponder 2

Uplink: 435.123–435.043 MHz (80 kHz)
Downlink: 145.866–145.946 MHz (inverted)

Output power: 10 watts maximum
Beacon CW telemetry (8 parameters): 145.948 MHz, 0.2 watts
Beacon digital telemetry (30 parameters): 1100 bps PSK
R+Scrambler 2 kHz deviation: 145.838 MHz, 0.4 watts
Beacon digital telemetry (30 parameters): 1100 bps PSK
R+Scrambler 2 kHz deviation: 145.800 MHz, 2 watts

PacComm modem connected and ready for microsat communications. A complete review of the PacComm modem is scheduled for a future issue of *73*. This unit is not a kit. It comes complete with cables and a detailed operation manual.

While integrating a PSK modem into a station is not a simple task, PacComm makes the chore less of problem with this plug-and-go unit. No tune-up procedures are required.

While the software difficulties with DOVE (DO-17) slowed the store-and-forward programming efforts with PACSAT (AO-16) and LUSAT (LO-19), pictures continued to come from WEBERSAT (WO-18).

Many of the images sent via PSK packets and decoded using Weberware 1.0 software for IBM PCs and compatibles were too dark, too light, or just impossible to distinguish. A few shots of cloud banks or coastlines were excellent, but hard to identify.

In late April, new software was uploaded to allow iris control and the use of the 1265 MHz ATV uplink receiver. It is hoped that these modifications will provide better pictures of the Earth, and opportunities for ATV stations to send pictures for retransmission via the PSK packet downlink format. WO-18 transmits on 437.102 MHz plus or minus about 10 kHz of Doppler shift. As the controllers at Weber State University in Ogden, Utah, gain more experience, the images from this fantastic experiment in space will improve.

New Publication

OSCAR Satellite Report continues the tradition of *ASR (Amateur Satellite Report)* with a biweekly newsletter sent via first class mail. The first issue was labeled "Number 194," signifying its continuity with the last *ASR* (No. 193). *ASR* was discontinued by AMSAT in favor of the more technical *AMSAT Journal*, a magazine published six times per year for AMSAT members.

OSR is a subscription-based publication, independent of AMSAT, but with ties to the goals and objectives of that organization. For those who do not monitor the AMSAT HF and satellite nets, and who do not have access to the packet radio AMSAT bulletins, *OSR* provides timely information via mail on the amateur satellite program. Additional features include various columns, such as "DXing the OSCARs" from John Fail KL7GRF, along with short articles and current orbital elements for existent hamsats.

OSCAR Satellite Report is published by R. Myers Communications, PO Box 175, Litchfield CT 06759. Subscription rates are $26.00 U.S., $27.50 Canada, and $36.00 elsewhere (in U.S. funds). 73

Regenerative Transponder RUDAK-2

Two onboard computers with IPS operating system for packet radio (AX.25) (Mailbox, telecommunications experiment with digital signal processing up to nearly 20 kHz, etc.), 1 megabyte RAM disk. Four separate uplink channels.

Gain of satellite RX and TX antennas: 2.3 dBi each (dipoles)
Input sensitivity: < −125 dBm (435 MHz) for a C/No of 45 dB Hz

Uplink

SAT-RX-1:	435.016 MHz ± 10 kHz 1200 bps FSK, NRZIC/Biphase-M (JAS, PACSAT)
SAT-RX-2:	435.155 MHz ± 10 kHz (AFC) 2400 bps, BPSK, Biphase-S
SAT-RX-3a:	435.193 MHz ± 10 kHz (AFC) 4800 bps, RSM, NRZIC/Biphase-M
SAT-RX-3b:	435.193 MHz ± 10 kHz (AFC) 9600 bps, RSM, NRZI (NRZ-S)+Scrambler
SAT-RX-4:	435.041 MHz ± 10 kHz (digital AFC) RX for RTX-DSP experiments

Output signals of RX-4 are the In-phase and Quadrature components, I(t) and Q(t), which are sent to the DSP RTX immediately after analog/digital conversion with 8 bit resolution. This supports various modulation modes, depending on the software. All other receivers provide data (D) and clock (C) at their outputs.

Downlink

The downlink can be switched to the following operating modes:

Transmit frequency: 145.983 MHz
Output Power: 2 watts nominal (10 watts maximum)
Mode 1: 1200 bps BPSK, NRZI (NRZ-S) (like FO-20)
Mode 2: 400 bps BPSK, Biphase-S (AMSAT mode for OSCAR-13 beacon)
Mode 3: 2400 bps BPSK, Biphase-S (planned for OSCAR-13)
Mode 4: 4800 bps RSM, NRZIC (Biphase-M) (like 4800 bps uplink)
Mode 5: 9600 bps RSM, NRZI (NRZ-S) + Scrambler (like 9600 bps uplink)
Mode 6: CW keying (only for special events)
Mode 7: SK (F1 or F2B), e.g. RTTY, SSTV, FAX, etc. (only for special events)
Mode 8: FM modulated by D/A signals from DSP-RISC processor (e.g. speech)
Power consumption: 14 volts at 350 mA (max) = 4.9 watts
Standby: 80 mA (RUDAK without power amplifier)
Mass: 6.2 kg
Dimensions: 230 x 320 x 120 mm

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- W2VS KW-40 Traps (pair)
- End-sulators™ (pair)
- #14-7 Copper Wire (125')
- Installation & Pruning Instructions

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The C-64 Inductance/ Capacitance Meter

Let this popular PC help you obtain values for capacitors and inductors.

by G.M. Gaskill KD9EN

Most amateurs can easily measure resistance, voltage, and current, but they usually have to guess the inductance from the mechanical dimensions. This home-brew product uses the Commodore 64 computer and a simple test circuit to measure inductance, capacitance, and frequency. It is a big help on any project which requires accurate values of inductors or capacitors.

This article is based on two earlier *73* articles: "All About Henry," in the November 1988 issue and "Computerized Frequency Readout" in the January 1988 issue. The original circuit has one component change, namely C1 (see Figure 1). The C-64 software program has been modified and expanded for the automatic calibration of the inductor (LS) and the determination of either inductance (LX) or capacitance (CX).

An Overview

The computer first measures and remembers the natural frequency of the inductor (LS) and the capacitor (C1). It then measures the frequency of LS, C1, and the unknown component. Finally, it computes the value of LS and the unknown component. It is not smart enough to determine if the unknown component is an inductor or a capacitor. Therefore, it gives two answers. You must decide whether it is a coil or capacitor.

C1—The Hard Part

This project requires the use of a stable capacitor, C1, of known true value. The accuracy of all measurements depends on this single component because the value of inductor LS is based on C1. This circuit is unique in that the output frequency is nearly totally dependent on LS, C1, and the unknown component. The best way to ensure the accuracy of C1 is to purchase a 0.01 µF Panasonic P-Series 2% tolerance Polypropylene Capacitor, a JE-3PLY 01 2.5% Tol. or equivalent.

However, it would be easier to purchase one with wider tolerances from a local electronic supplier, then ask the clerk to measure it on one of his demonstration digital capacitor meters.

Once you learn the exact value of C1, change line 1010 in the program to that value. Take care to insert the value in farads. For example, C = 0.01005/1000000 or C = 0.009983/1000000 will do nicely.

Ideally, the inductor should be a toroid in order to avoid mutual coupling between the LS and the coil under test. A hand-wound toroid is easy to make. Fifteen to 20 turns of wire on a toroid form should do the job. However, you can also use a Radio Shack 0.1 mH choke and RS 273-102. The natural frequency of LS and C1 must never exceed 655,350 Hz. This would cause an underflow in line 320.

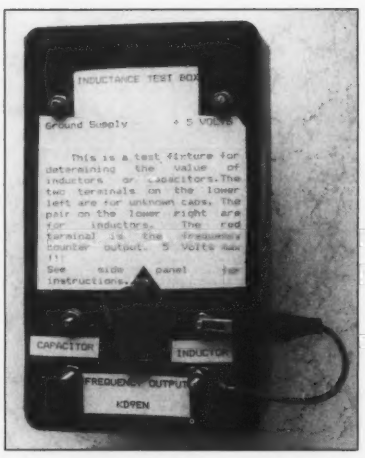
INDUCTANCE TEST BOX
Ground Supply
+ 5 VOLTS
This is a test fixture for determining the value of inductors or capacitors. The two terminals on the lower left are for unknown caps. The pair on the lower right are for inductors. The red terminal is the frequency counter output. 5 volts aux !!!
See side panel for instructions.
CAPACITOR
INDUCTOR
FREQUENCY OUTPUT
KD9EN

Photo A. Test fixture for measuring inductance and capacitance.

The Hardware

It would be best to mount the circuit board within a metal box, but it is not absolutely necessary. I used clip leads for all external connections (see Photo A). A switch, however, would be more convenient.

The normal current drain for the circuit is 4.0 mA. It would be prudent to test with an external power supply before connecting to the C-64.

The Software

The C-64 has a built-in counter and a time interval program. The counter counts down from 65535 and must not go below zero dur-

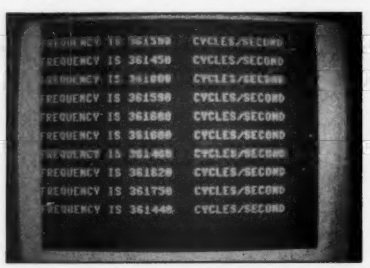
FREQUENCY IS 361450 CYCLES/SECOND
FREQUENCY IS 361590 CYCLES/SECOND
FREQUENCY IS 361800 CYCLES/SECOND
FREQUENCY IS 361800 CYCLES/SECOND
FREQUENCY IS 361820 CYCLES/SECOND
FREQUENCY IS 361750 CYCLES/SECOND
FREQUENCY IS 361440 CYCLES/SECOND

Photo B. Repeating display of measured frequencies. Wait until the frequency displays (and thus the oscillator) stabilizes before seeking the desired component value.

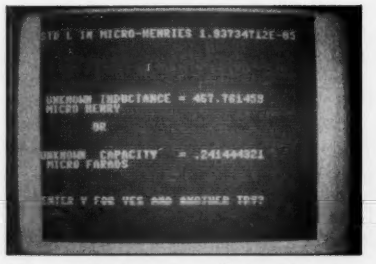

Photo C. The final screen display, giving you a choice of solutions for the unknown component.

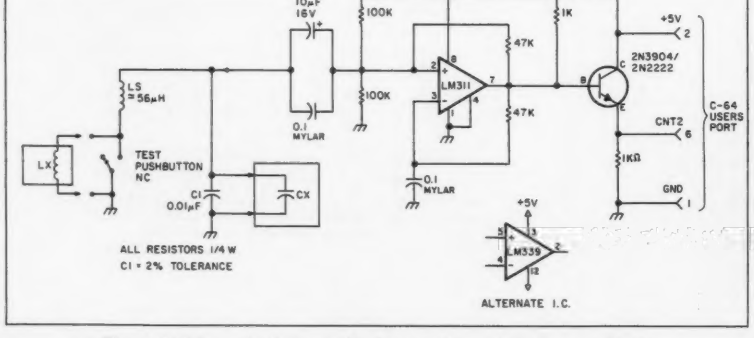

Figure 1. Schematic diagram of inductance/capacitance meter circuit.

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PROGRAM LISTING

```
8 REM FILE NAME   MEASURE L/C
9 REM AUTHOR GEORGE M. GASKILL KOKOMO,        INDIANA  KD9EN
10 REM C-64 DIGITAL FREQ COUNTER
11 REM REF 73 MAG. JAN 1988 PAGE 35/36
12 REM MAX COUNT = 65535
13 REM ACTUAL COUNT IS (65535- COUNT)
14 REM COUNT BASED ON JIFFY COUNTER
15 REM 60 JEFFIES = 1 SECOND LINE 290
16 REM INPUT IS ON PIN CNT2  USERS PORT
17 REM CNT2 IS PIN #6 ON USERS PORT
18 PRINT"{SC}"
20 PRINT"THIS PROGRAM MEASURES FREQUENCY,"
22 PRINT:PRINT"    INDUCTANCE AND CAPACITANCE."
24 PRINT:PRINT:PRINT"IT REQUIRES THE USE OF A SPECIAL"
26 PRINT:PRINT"    TEST BOX."
28 PRINT:PRINT:PRINT"THE FIRST TEST IS A CALIBRATION"
30 PRINT:PRINT"    TEST WITHOUT ANY UNKNOWN COMPONENT"
32 PRINT:PRINT"    IN THE CIRCUIT."
34 PRINT:PRINT:PRINT" WHEN THE FREQ. SETTLES DOWN,"
36 PRINT:PRINT"    HIT THE RETURN KEY"
37 PRINT:PRINT" ******    PLEASE WAIT    ******"
42 FOR J=1 TO 9000:NEXT
120 DATA 8,120,169,20,141
130 DATA 20,3,169,192,141
140 DATA 21,3,169,3,141
150 DATA13,221,40,88,96
160 DATA 72,198,255,240,4
170 DATA 104,76,49,234,165
180 DATA 251,133,255,169,0
190 DATA 141,14,221,173,5
200 DATA 221,133,252,173,4
210 DATA 221,133,253,169,255
221 DATA 141,5,221,141,4
230 DATA 221,169,33,141,14
240 DATA 221,104,76,49,234
250 FORI=0TO64
260 READX
270 POKE(49152+I),X
280 NEXTI
285 REM BASE=60 MEANS ONE SECOND OF COUNT
286 PRINT"{SC}"
290 BASE = 06: REM 1/10TH SEC.
300 POKE255,0:POKE251,BASE
310 SYS49152
320 COUNT=(PEEK(252)*256+PEEK(253))
330 F =(65535-COUNT)*10:IFF=655350GOTO450
331 PRINT:PRINT"FREQUENCY IS"; F; "  CYCLES/SECOND"
450 FORW=0TO1000:NEXTW
460 GETA$:IFA$=CHR$(13)GOTO480
470 GOTO320
480 PRINTCHR$(147):GOTO 520
520 PRINT"{SC}"
530 PRINT:PRINT:PRINT" THE FREQUENCY =";F;" HZ"
532 PRINT:PRINT"      XXXXXXXXXXXXXXXXXXXXXX    "
540 PRINT:PRINT"IF THIS IS THE CALIBRATION"
550 PRINT:PRINT"    FREQUENCY PRESS F."
560 PRINT:PRINT"PLACE THE UNKNOWN IN THE CIRCUIT"
580 PRINT:PRINT"   AND ENTER S FOR SECOND FREQ."
585 PRINT:PRINT:INPUT" ENTER F OR S";B$
590 IF B$=CHR$(83) THEN 700
600 PRINT" KEY = F": FT=F:GOTO320
700 PRINT" KEY = S": GOTO 1010
1010 C= .01000/1000000
1020 PRINT"{SC}"
1040 L=1/(39.4784176*FT*FT*C):PRINT
1050 PRINT"STD L IN MICRO-HENRIES";L
1060 PRINT:PRINT
1080 PRINT : PRINT: PRINT
1090 L1=1/(39.4784176*F*F*C)
1100 C1=1/(39.4784176*F*F*L)
1110 LS = (L1-L)*1000000:REM MICRO HENRY
1120 PRINT
1130 CS = (C1-C)*1000000:REM MICRO FARAD
1140 PRINT" UNKNOWN INDUCTANCE =";LS;"        MICRO HENRY"
1150 PRINT:PRINT"        OR   "
1160 PRINT:PRINT
1170 PRINT"UNKNOWN  CAPACITY   =";CS;"        MICRO FARADS"
1190 PRINT:PRINT:PRINT
1191 INPUT"ENTER Y FOR YES AND ANOTHER TRY";A$
1192 IF A$ = CHR$(89) GOTO 320
1193 PRINT"  ++++++ END  OF  PROGRAM ++++++"
1194 PRINT"   ---- BYE BYE KD9EN ---"
1210 END

READY.


READY.
```

ing the counting interval. The counting interval is divided into jiffies. Each jiffy is 1/60 of a second. Line 320 contains the count and line 290 contains the number of jiffies, namely six. Thus the counter counts for just 1/10 of a second. The program for reading frequency begins with line 120 and ends with line 280. Line 310 activates this subroutine. Line 330 calculates the frequency.

The calculations for inductance and capacitance use the well-known relationship of inductance, capacitance, and frequency. These appear in lines 1040, 1090 and 1100. Because the unknown inductor is in series with LS, or the unknown capacitor is in parallel with C1, it is necessary to subtract either LS or C1 to obtain the value of the unknown component. See line 1110 and line 1130. Lines 18, 286, 520 and 1020 require special attention. The four characters within the quotation marks represent shifted clear, SC. This command is achieved by pressing the shift key while striking the CLR/HOME key. An inverted heart-shaped graphic will appear on the screen.

"This circuit is unique in that the output frequency is nearly totally dependent on LS, C1, and the unknown component."

Operating Instructions

The user's port is located on the left rear and has 24 pins in two rows of 12 each. Viewed from above and while sitting in front of your Commodore, pin #1 will be to the far right. Pin #12 will be to the far left. These pins are located on the upper row of pins. Check your owner's manual.

1. Connect the circuit to the C-64 before turning on the computer.
2. Load and Run the program.
3. Make sure that the lower connection to LS is connected or switched to ground.
4. There will be a screen display and short delay. Then the frequency display will begin repeating itself (see Photo B). After the frequency stabilizes, hit the return key.
5. It will ask if this is the first (F) or second (S) frequency display. Enter F and hit return.
6. Connect the unknown component into the proper part of the circuit. If it is an inductor, press the switch to test or connect the coil in series with LS and ground. If it is a capacitor, connect in parallel with C1. Wait for the frequency to stabilize, and then hit return.
7. This is the second frequency display, enter S and hit return.
8. Two sets of results will appear. You must select the proper value, depending on the type of component (see Photo C).
9. Enter Y to continue, N to quit.

Parts List

Quantity	Value, Type	Description
2	1kΩ	resistors
2	47kΩ	resistors
2	100kΩ	resistors
2	1 µF	Mylar™ capacitor
1	10 µF 16V	capacitor
1	0.01 µF 2%	capacitor
1	56 µH	inductor
1	LM311 or LM339	IC
1	2N2222 or 2N3904 NPN	transistor
1	SPDT	Momentary Switch
1	24-pin connector	for user's port

Parts are available at Radio Shack.

The inductor can be 26 turns of #26 enamel wire on an Amidon FT-37-61 Ferrite Toroid (125 mu). This should produce about 40 µH. Amidon Assoc., 12033 Otsego St., N. Hollywood CA 91607.

Final Words

There does not appear to be a limit on the range of inductors which this system will measure. However, electrolytic capacitors do not perform properly, and capacitors larger than 0.25 µF cause strange oscillations higher than the calibration frequency and give false results. Bear in mind that absolute accuracy is not attainable because of inductive and capacitive stray coupling of the wiring and components.

My compliments to Mr. W.K. McKellips WB4DCV for the excellent oscillator circuit used in this application, and to Mr. William Bawn WA9RDE, who wrote the original program and helped me correct a defect in my use of his work. My thanks to John DeLong W9BYN for his help and encouragement. 73

George M. Gaskill KD9EN, a retired physicist, also builds grandfather clocks. He prefers RTTY to code, and he's on 14.318 MHz nearly every morning about 1500 hours Zulu with the "Delco" net. He will provide a diskette with the program and a calibrated 0.01 µF capacitor for $8.00 ppd. Write him at 1511 N. Phillips St., Kokomo IN 46901.

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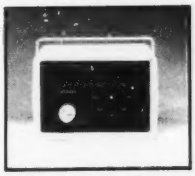

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Confessions of a foxhunting junkie.

by Clifford Vaught N9FHF

In the summer of 1984 I was first introduced to foxhunting. I was fascinated with it early on and now have become hopelessly addicted to the sport. Yes! After much deliberation over my direction finding activity, I hereby unequivocally admit to the amateur radio world, and to myself, that I am a foxhunting junkie.

They say that admitting your addiction is the first step to recovery. Then one must join a support group. I have already done that. Although, I sometimes wonder, as does my wife, if I'm getting the right kind of therapy. I joined a group of other foxhunting enthusiasts who meet regularly to discuss the thrills and chills of the activity. But, let me warn you about how I got hooked on this "drug."

A few months after I received my ham ticket, Paul Bohrer W9DUU was the guest speaker at our repeater association meeting. As I watched him carry in some of his equipment, I was interested in the pieces that looked like H's on long poles. There were tall ones and skinny ones, short ones and fat ones. Some appeared to be made of wood, others of plastic. Some were not much more than wire and tape. No two of them seemed to be exactly alike. Other pieces of the equipment I recognized as beam antennas. Then there were those metal boxes with meters and LEDs. I knew I had a lot to learn.

Challenged by the Force

As Paul began describing how some of his gear was made and used, my interest was piqued. Then, when he got into some of his war stories, my attention was arrested. Suddenly, as if being born anew, I saw foxhunting as I never thought I would. It was not about home-brewing those funny little antennas. Foxhunting was about a challenge. A dare to the amateur from an invisible force. It was as if radio frequencies were saying to me "I dare you to locate my source. You, with such limited radio knowledge will never be able to track me down." Well! That was just about all I needed.

Our speaker went on, and I began to feel the romance of the sport. I could be like a knight going into battle and conquering over the evil enemy. And, not only was there the three F's: fun, food and fellowship, but a practical side also.

Paul told of tracking stuck police transmitters and kitchen appliances causing TV interference; of ferreting out malicious interference and DFing stolen radios. Wow! I had really hit the jackpot. I could become a knight, conquering evil with my lance made in the shape of an H. What more could a middle-aged romantic want out of life?

Photo A. Cliff N9FHF, conquering evil with a lance made in the shape of an H.

My two friends and I decided to build antennas and enter the next monthly hunt. After all, it seemed harmless enough. The battle started out easily. We assembled with the other DFers for the September hunt. Using only the buzz box or H antenna, we decided to triangulate our headings from different locations. It was a beautiful day for the activity. The fox had hidden and was ready to make his first transmission at 1:45 p.m. We waited anxiously. When the signal came, we took our reading and drew a corresponding line on our map. Then, after moving about five miles to the northwest, we found an open area and took our second reading. Another line was drawn. The two lines intersected a few miles to our northeast.

Thrilled that the system was working just as W9DUU had said, we jumped back into the car and headed to where "X" marked the spot, thinking this was really going to be a snap. We entered the area less than a hundred yards south of our X. The next reading we took put our third line almost directly through the bull's-eye.

The problem we faced was it was one of those "you can't get there from here" situations. Dead-end streets, woods and ravines were in front of us. We wandered around trying to find a shortcut to the other side, but we ended up being led astray by multipath and our own uncertainties. We crisscrossed back and forth, taking few readings but checking out every place where we just "knew the fox had to be."

A First Success

Finally, we recognized an area just a little north of the spot from which we had taken our third reading. Upon finding an open area, we waited for the next transmission. This time our heading was almost due south. We could see no street there, but the map showed one coming in from the west that ended in a cul-de-sac due south of us. Eureka! The sly old fox had been found. It was 2:30 p.m., and we were the first ones to find the little animal. We headed for the local burger shop to wait for other hunters so we could boast and otherwise be stroked.

We waited and waited for someone else to show. We began to wonder if this had really been a snipe hunt, with us left holding the bag. Then at about 4:00 p.m. we heard on the radio that two hunters had given up and gone home. Then at 4:30 came the announcement

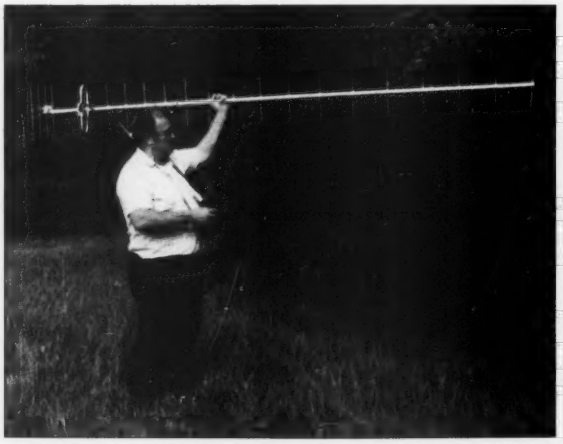

Photo B. Tom N9DZJ with his "secret weapon" foxhunting beam.

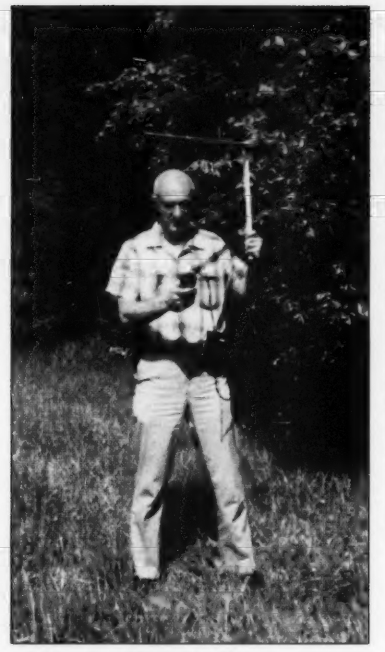

Photo C. Paul W9DUU homes in on the fox.

that everyone else had spent the entire time searching the forest on the grounds of Fort Harrison, feeling sure the fox had hidden there. That was an easy error to make since the sly one was only about three hundred yards to their northwest. The multipath caused by the trees had done just what the fox had hoped for. Everyone was told to pack up and go home for the day.

We did, but with great disappointment, since we had planned to bask in the limelight. Of course, the old pro lost-in-the-woods hunters were very disappointed, too. Talk about frustration!

The result of all these hunts over the years is that we have a strong core of about a dozen hunters who are at almost every hunt. Even in January and February we commonly have eight to ten people show up ready to go. Not only have we had fun all this time, we've also solved some serious interference problems.

Any Time

Now about this support group I have joined. There is a very definite cluster of hams here who are also, without question, foxhunt junkies. These people are: Tom N9DZJ, Paul W9DUU, Bernie KB9AWS, Larry WB9YAJ, Keenan N9HCK, Mike WA9FDO, Kevin N9FWB, and myself, N9FHF, along with maybe one or two more who will go foxhunting at the drop of a frequency. Not only on scheduled, monthly games, but also on frequent, impromptu games sometimes held as often as several times a month.

Impromptu foxhunts are usually held at night, starting around 10 p.m. to midnight. One of the group might put out a CQ FOX HUNTERS call, then tell us he has hidden and to come find him. Or, maybe, in a QSO someone will urge another to be the fox for that night. If neither of those happenings occur, two or three persons will search various bands with a scanner. If a problem frequency can be found, or just one that seems interesting, someone might ask, "Where do you suppose that signal is coming from?" Often, after discussing it a few minutes, the hunt is on.

There is much diversity in both our group of junkies and our regular folk. Backgrounds include lawyer, salesman, electronic tech, TV station engineers, toolmaker, real estate agent, home inspector, disabled, retired, to name a few. Equipment types range from small signal strength meters to buzz boxes, left/right boxes—mostly those of Paul Bohrer W9DUU design—to Doppler boxes and beam antennas. Several of us are now using marine direction finders along with other tools of the trade. Hidden transmitters have been almost everything from 100 mW oscillators to 100 W, or more, amplifiers. Distance traveled by those in our group during a hunt has been as little as a few miles to as many as 450 miles. The group has hunted and found transmitters as far away from Indianapolis as the Kansas City area, as well as in southern Indiana, northern Kentucky, and western Ohio.

Over the past two years we have gotten excited about tracking "bring 'em back alive" weather balloons carrying ATV equipment, including a video camera. It's just like what they say about the rest of the hobby—"something for everybody."

Are you having a hunt in your area soon? Let us know. We would like to join you. But then, if you're as addicted as we are, you would rather join us. Wouldn't you? Let's talk about it. 73

Clifford F. Vaught N9FHF may be reached at 5350 Kilmer Lane, Indianapolis IN 46250.

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UPDATES

Get the Right Number

The phone number for GE Electronic Services is (708) 595-4343. The number given on page 72 of the April 1990 issue is incorrect. GE Electronic Services is listed in the lower right box, "Independent Kenwood Service Center Specialties," in the "Kenwood Corporation Service" article.

73

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Getting "Hooked Up" Right

Have you ever had an equipment problem, but when you sent the rig in for repair, the shop claimed there was nothing wrong with it? Ever pulled a malfunctioning radio from your car only to have it work fine on the bench? Worse yet, have you ever moved a rig from one corner of the room to the other, only to find its behavior markedly different? If any of these things has happened to you, then you know what frustration is! What makes equipment act differently from one location to another?

Machines are somewhat like living things—they interact with, and are really inseparable from, their environments. A metal box is a metal box, and it should work the same wherever you put it, right? Not so fast. What about temperature? What about invading magnetic and electromagnetic fields? And especially, what about all those plugs and cables linking the box to all the other boxes?

The way your equipment is "hooked up" can greatly influence its performance, and often does for the worse. Sure, we all know about RF feedback getting into the mike cable, but the issue is much broader than that. If you're like most of us, you have lots of interconnected gear, like HF and VHF rigs, TNC, computer, amplifier, etc. And you may have found your station's performance deteriorating with each added cable.

RF Feedback

The biggest interconnection problem we amateurs face is getting all the equipment to work together without getting RF feedback. Not only can RF get in directly from the transmitting antenna, but it can emanate from the chassis of the radio as well. That happens because the chassis is one half (ground) of the circuit going to the antenna. It helps if you've got a good station ground, but even that is not a sure-fire cure.

The mike input is sensitive to very low voltage levels. It has to be, because microphones don't put out much. Unfortunately, audio amplifiers, especially today's solid state types, can act as diode detectors, because transistor junctions are essentially diodes. So, you've got a sensitive input driving a powerful output (your transmitter). Sure sounds like a feedback loop to me!

I have received a number of questions regarding the proper matching of microphones and rigs. The most important characteristic is the impedance of both the mike and rig. If there's a significant mismatch, the hookup will be very susceptible to RF. It is also likely to sound lousy. So always match the rig with a mike of the same approximate impedance. Most modern radios are designed to use low-impedance mikes of around 600 ohms. These can be dynamics or electrets, but never crystal or ceramic mikes unless they include a matching transformer.

Tube rigs, the kind with all tubes (as opposed to just driver and finals), are usually just the other way around. They require high-impedance mikes, and work best with crystal or ceramic units.

Some rigs, such as late-model Kenwoods, use two ground wires in their mike connectors. One goes to the chassis, and is used for the PTT function. The other is the shield of the mike cable, and goes directly to the ground on the mike amplifier board. This technique helps avoid stray RF by keeping chassis currents away from the mike amp, and defeating it by connecting the grounds together is just asking for trouble.

Other Inputs

Most likely, the mike is not your radio's only input. If you have a RTTY terminal unit, TNC, SSTV converter, or any other gadget connected, it too can be a source of trouble. It is very important to use shielded cable for *anything* that feeds signals to your rig. Even if the unit connects in the back of the radio at an auxiliary jack, it must use shielded cable.

It is also wise to use it for signals exiting the radio. You may have an external speaker, or, of course, be feeding audio to the RTTY or packet unit for receive. You may think you don't care what hits those connection wires in transmit (after all, you only use them for receive), but in fact they can be the paths for induced RF even when not in use.

Lead Dress

If you've got an RF feedback problem, take a look at the positions of the various wires, especially with respect to the antenna coax. Sometimes, just moving them a few inches apart will cure the problem. This particularly seems true when high power is involved. I remember one setup where I had terrible feedback with the linear amplifier on the left side of the rig, but not when it was on the right! (And yes, I had a decent ground.) It turned out that the amp's output coax, which crossed behind the radio, was just too darned close. With the amp on the right, the cable was nowhere near the rig.

Power Supplies?

Yes, their output wires can be trouble, too. This problem seems to show up more at VHF than at HF, and especially with "brick" amplifiers. The wires can resonate at 2 meters, 220 or 440 MHz, and the usual symptom is bad hum on the audio. Although it's often not practical to shield the wires, you can wrap them through a toroid just behind the rig, and that may fix it. Also, keep brick amps away from both the power supply and radio, as either can cause problems.

If you use a switching power supply, be sure to keep its output wires as short as possible. Switching supplies are more sensitive to high-frequency signals being induced through their leads than are linear types. Also, some switchers go nuts with long leads, even in the absence of external fields. The leads' inductance upsets the action of the chopping regulator.

Making Connections

The jacks on your rig are their most vulnerable points. Connect DC power backwards or short the wrong pins while testing, and you can do some real damage. It's wise to avoid soldering anything while it is connected to the radio. Pull it first, then check for errors before you plug it back in and power it all up.

Some of the sloppiest work I've ever seen has been on connectors, particularly audio plugs. If you short your speaker output, you will likely blow the audio amp IC or output transistors. If your mike plug, which can get heavily stressed in mobile applications, should short, problems can range from an inability to key the rig to no audio to circuit damage. Don't use cellophane or masking tape, and *never* count on unsoldered, twisted-together wires. Solder the connections properly, and if electrical tape is called for, use the real thing. Also, consider using heat-shrink tubing; it's neater and doesn't unravel and leave a sticky mess like tape usually does.

One handy way to insulate connections and also provide a bit of strain relief is to use hot melt glue. Glue guns are cheap, and if you do any wiring or fabricating on a regular basis, you should have one. The "glue" is really thermoplastic, and it forms around nearly anything and dries as fast as it can cool. If you squirt it into an audio plug, you know that plug is *forever*. You probably won't be able to get it apart, even if you want to. The glue peels easily, though, from most flat surfaces.

Serial Ports of Call

If you have a computer or TNC in your shack, it's almost certainly connected to something via a serial cable. Many of these are unshielded. If you get computer hash in the receiver, or continue to have RF feedback despite your best efforts, the computer cable may be the culprit. Try wrapping it in aluminum foil and using an alligator clip to connect the foil to ground (because, alas, you can't solder to aluminum). It's not the world's greatest shield, but it's a heck of a lot better than nothing. Also, try wrapping the cable through toroids at each end. That may reduce the problem, particularly at VHF and UHF.

When soldering connectors with multiple wires and pins, be careful not to overheat the wires, or the insulation can crawl up the wire, leaving bare conductor. A few of these near each other can spell disaster. Never count on space alone to keep wires apart; they have a nasty habit of inching toward each other in the dark, when no one's looking. Again, hot melt glue is a great way to avoid trouble.

Wiring power supply connectors requires extra care, because a short can mean lots of amps and maybe even fire. At the least, you'll probably blow the supply's fuse. In heavy-current applications, be sure to use big enough wire. Don't try to run a 20-amp HF mobile rig on #18 hookup wire! Such small wire has too much resistance, and will dissipate its voltage drop as heat. Sometimes it can get hot enough to melt its own insulation. I once saw a 12-inch clip lead wire glow red and burn up when accidentally connected directly across a 2-amp gell cell VCR battery. Ouch!

For the same reason, don't try to run high-current radios from a cigarette lighter plug. I tried it with an HF rig once, and midway through a transmission, the tip of the plug got so hot that it began to melt the plastic plug. The olfactory warning got me off the air in a hurry.

Due to their inherently poor design, PL-259 connectors are a real pain to solder. We all have our favorite methods of doing the shields, and some work better than others. As a rule, though, you need lots of heat. No 30-watt irons here. Break out the big gun, or consider using a small torch. The other big problem with these plugs is that when you get them hot enough to solder the shield, they often melt through the center conductor, causing a direct short. There's no easy way around this. Just try to hold the cable so that the center wire doesn't contact the plug body. Also, if your shield soldering method allows it, use a heat sink on the shield, between where you solder it and the rest of the coax. Clamped forceps or tightly-held needle-nose pliers will work fine.

Well, I could go on and on about this sort of thing, and it may seem like this column has been a series of "don'ts." But if you take care in the connecting and placement of your equipment, you will find that getting it all hooked up correctly can often save you from having to get it fixed.

See you next month, and keep those cards and letters coming. 73

Number 24 on your Feedback card

NEW PRODUCTS

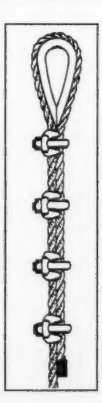
Compiled by Hope Currier

PRODUCT OF THE MONTH

WALKER SCIENTIFIC INC.

Walker Scientific Inc. has announced a new monitor for measuring potentially-hazardous low-level electromagnetic field radiation and getting accurate readings on a digital display. The ELF-50D Field Monitor is a hand-held instrument that accurately measures the extra-low-frequency (ELF) electromagnetic radiation generated from power lines, TVs, video displays, home appliances and other equipment. Just switch it on and hold it where radiation is suspected and the reading will instantly show on a 3½ digit LCD display. It is calibrated to measure the electromagnetic radiation generated from any 50 Hz or 60 Hz device with ±1% accuracy and has two switch-selectable measurement ranges: a low range from one milligauss to two gauss, and a high range up to 20.0 gauss. Calibration is traceable to NIST (previously NBS). The instrument is pocket-sized and powered by a 9 volt alkaline battery.

The ELF-50D sells for $225 (list). For more information contact *Walker Scientific Inc., Rockdale St., Worcester MA 01606. (508) 852–3674, (800) 962–4638, FAX (508) 856–9931.* Or circle Reader Service No. 201.

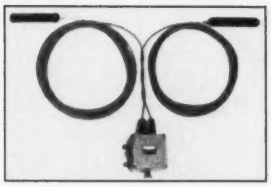


PHILLYSTRAN

The HPTG "I" from Phillystran is a field-installable non-metallic guy system manufactured from high strength, low stretch Kevlar™ fiber. This new version of the HPTG products is designed to assure dependable performance with field-installable wire rope clips. It is priced about the same as the original product because the potting compound and sockets have been replaced with inexpensive wire rope clips.

For more details and price information contact *Phillystran, United Ropeworks (U.S.A.) Inc., 151 Commerce Drive, Montgomeryville PA 18936. (215) 368–6611; FAX (215) 362–7956.* Or circle Reader Service No. 204.

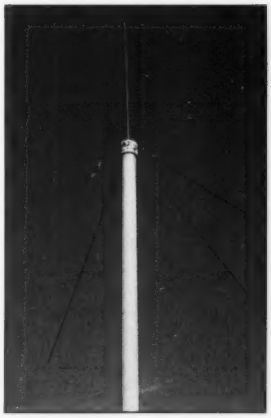
POYNTEK ASSOCIATES



Poyntek Associates has announced a family of wideband monopole (vertical) antennas for the high fractional bandwidth, low HF amateur bands, eliminating the need for antenna tuners and special radiator networks. Snyder Full-Band™ wideband antennas for the 40, 75/80 and 160 meter bands are designed to allow maximum use of modern broad frequency range continuous or digital tuned transceivers and "no tune" power amps to 1.5 kW PEP output. The three models (VFB-40X, VFB-75/80X and VFB-160X) are constructed of high quality, high insulation resistance space-age plastics and high conductivity, corrosion-resistant non-ferrous metals to provide low weight, low wind drag, and weather endurance for years. They also include optimized feed modules for a broad range of ground radial system sizes and ground characteristics. These antennas are modular for user assembly and installation.

Model VFB-40X is priced at $210, VFB-75/80 is $250 and VFB-160X is $350. Contact *Poyntek Associates, P.O. Box 741, Placentia CA 92670. (714) 993–7525.* Or circle Reader Service No. 202.

CELLULAR SECURITY GROUP



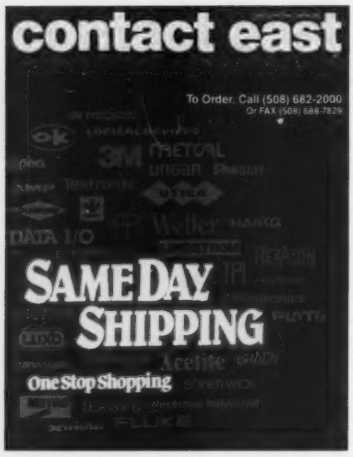
Thomas Bernie KØTB/1 has announced an adaptation to ground plane antennas, constructed by attaching elements to SO-239 connectors: the MAX System antennas. These antennas are built according to Handbook dimensions by soldering stainless steel elements directly to a connector placed inside a precision-drilled one-inch PVC cap. This design results in a simple, rugged, weatherproof antenna at a reasonable price. The antennas are shipped fully assembled with instructions and a six-inch PVC mounting mast. All the user has to do is connect the coax and mount the antenna.

The MAX146, MAX220 and MAX440 are priced at $29.95 each, with free shipping and handling and a money-back, "no time limit" guarantee. Optional Type N connectors or 38-inch mounting masts are available for $5.00 each. Contact *Cellular Security Group, 4 Gerring Road, Gloucester MA 01930. (508) 281–8892.* Or circle Reader Service No. 203.

MICROCRAFT

Microcraft Corporation has introduced CODE SCANNER, a new advanced two-line 32-character multimode decoder that copies Morse, Baudot and ASCII codes from your radio. CODE SCANNER features a built-in code practice oscillator for hand key with readout to the display, a built-in speaker, advanced analog and digital filtering with AGC, and a special practice mode for learning the Morse characters. The CODE SCANNER is compact (3½" x 5¾"). It operates from 12 VDC or 120 VAC with the adapter provided. Hook-up to a radio speaker or headphone jack is easy.

The price for CODE SCANNER Model CSCAN is priced at $189 plus $5 S & H. Contact *Microcraft Corporation, P.O. Box 513, Thiensville WI 53092. (414) 241–8144.* Or circle Reader Service No. 206.



CONTACT EAST

The new *1990 General Catalog* from Contact East is a complete sourcebook of products for testing, repairing and assembling electronic equipment. This 148-page book contains products for engineers, managers and technicians and introduces many new oscilloscopes, static protection products, soldering supplies and stations, test equipment, precision hand tools, plus Contact East's exclusive line of tool kits. It also features expanded lines of voice/datacommunication test instruments, wire and cable aids, electronic adhesives, magnifiers, and inspection equipment. The catalog describes all products in detail and includes specifications, full color photos and prices. Purchases come with an ironclad guarantee. Contact East's "Same Day Shipment" policy ensures fast delivery; orders received by 4 p.m. are shipped by 5 p.m.

There is no charge for this catalog. For more information call *(508) 682–2000* or write to *Contact East, 335 Willow St., No. Andover MA 01845.* Or circle Reader Service No. 205.

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Micro-Circuits Co., Inc. is offering, at no charge, a new electronic shielding design kit for consultants, business owners and home owners. The NR 02a design kit shows how to use low cost NR2HF rubber paint shielding to prevent the rising tide of electrical interference from causing unreliable performance by computer, medical, security, recording and communications equipment. Unlike conventional electronic shielding which is far too costly and wasteful of space for most businesses and homes, the NR2HF rubber paint shielding is easy to apply. It has been widely used in industry for more than five years and in the space program for two years.

To request the NR 02a kit contact *Micro-Circuits Co., Inc., 10800 Maudlin Road, New Buffalo MI 49117. FAX (616) 469–2742.* Or circle Reader Service No. 208.

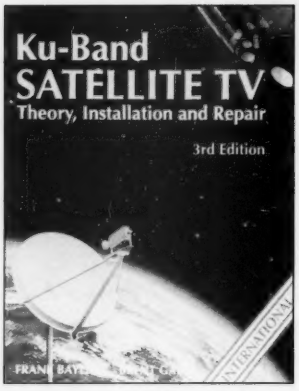
ELECTRON PROCESSING

Electron Processing, Inc. has announced a new filter that eliminates interference to shortwave reception caused by strong VHF/UHF signals. The LPF-1 effectively reduces signals from TV, FM and two-way radio stations from the antenna line of any shortwave receiver. It is designed to connect in the antenna lead between your antenna and receiver, and filter out signals on all frequencies above 50 MHz. Signals in the FM broadcast band are reduced at least 100 times in strength, yet signals below 30 MHz are virtually unaffected. This filter uses a two-stage low-pass filter network which requires no power to operate. The unit is housed in a compact 2″ x 2″ x 1″ rugged metal enclosure with BNC female connectors provided for easy connection in your antenna system.

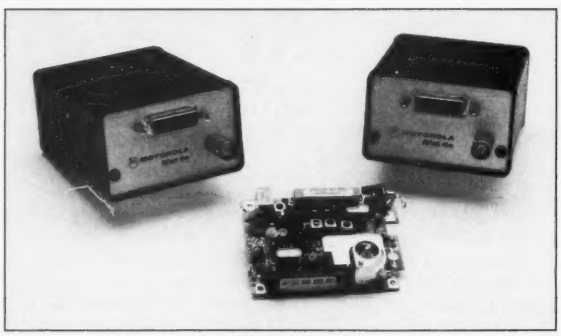
The LPF-1 is priced at $19.95. Contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621. (616) 228–7020.* Or circle Reader Service No. 209.

BAYLIN PUBLICATIONS

Baylin Publications has announced the release of the third international edition of *Ku-Band Satellite TV—Theory, Installation and Repair* by Frank Baylin and Brent Gale, with technical contributions by John McCormac. This comprehensive source of information and explanations covering all aspects of worldwide Ku-band satellite television systems has been extensively revised and expanded in scope. The 40 pages of new information covers European DBS satellite TV, flat plate antennas, LNB and satellite receiver electronic design, worldwide scrambling technologies, link analysis, fixed antenna installations, interfacing receivers and decoders, and instructions for aligning a polar mount without a compass.



This 8½″ x 11″ 432-page manual contains over 400 up-to-date photographs and illustrations. It is available from *Baylin Publications, 1905 Mariposa, Boulder CO 80302* for $29.95 plus $2 S & H. For more information circle Reader Service number 207.



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About the Mail

I have been getting quite a bit of mail these days. I want to thank all who have written. I try to answer your letters, especially those that come with self-addressed, stamped envelopes. However, I do have a bad habit; I tend to let the letters stack up until the stack threatens to engulf the top of my desk/workbench, so forgive me if you do not get a response for a month or so.

You may notice that I have included my BBS address and my Internet address along with my US Postal Service address. I encourage you to use electronic mail to reach me. I tend to respond to my electronic mail the moment that I receive it so you are likely to get an answer very quickly. For those of you who use CompuServe, I am sorry to say I no longer use CompuServe. It simply costs too much, and since CompuServe now offers electronic mail service to the Internet, you can reach me that way.

Responses to the April Column

Back in April I wrote on the rather slothful state of affairs in US amateur packet radio. I have received a number of communications regarding that column. Surprisingly, they have been overwhelmingly positive. I did get one somewhat negative letter from Joe G3ZCZ (G3ZCZ @ N4QQ).

Joe writes: "Brian, about your packet editorial, stop moaning and make some constructive suggestions. There are 3 main problem areas: 1) The lack of applications, although people are beginning to bring up new servers; 2) the present system's inertia—you can't do something new because the system doesn't support it; and 3) the user interface. People who don't know the difference between 'converse' and 'command' are given a choice of 100 different commands [in their TNCs]. It scares them off."

I tend to disagree with Joe that I am moaning and not making constructive suggestions. I have been making constructive suggestions for quite some time now; in fact, for the better part of a decade. I write this column, I write articles, I talk at radio club meetings, I help other hams construct their stations, and I help build and maintain the packet radio facilities where I live. I tend to consider myself as a doer rather than a casual bystander. I helped construct and maintain the first relatively large TCP/IP-based packet radio network in the Washington, DC, area. All-in-all, I think that I have more than paid my dues to the packet radio community.

Joe's other points are well taken. His first point, lack of applications, is significant. How many times have you demonstrated packet radio only to be asked, "But what is it good for?" Did you find yourself with no good answer? I know that I certainly have on occasion. I do like to point out packet radio's usefulness for the National Traffic System, the DX packet cluster, and moving health and welfare information during times of crisis. The BBS has made unattended electronic mail possible for thousands of hams. How many of you have scheduled HF QSOs via packet radio? It even works for many DX stations.

All this is well and good, but you may note that it doesn't include any real-time applications. Packet radio today tends to be rather like the tortoise from the old fable; slow and steady wins the race. To make new real-time applications like digital voice, digital video, and computer file servers possible we are going to need much faster radios and modems. In the meantime, what ideas do you have for new applications? Send them along and I will publish them.

Joe's second point is also very significant. There tends to be a good deal of inertia when it comes to new ideas. There have been hams who have tried to accuse me of trying to ruin packet radio for "legitimate users" by running TCP/IP. Gee, if people like that would spend half as much time and effort working to improve packet radio as they do complaining, we would have a much better packet radio network (HI).

Personally, I think that most of the inertia centers on education. Hams traditionally have striven to learn and master new technologies. If you have knowledge, perhaps you could go out and talk about some aspect of packet radio that interests you. Perhaps you could even put together a small group interested in experimenting with some new technology or application for packet radio.

Joe's last point disturbs me. He implies that the command set in the TNC is difficult to learn and that packet radio should somehow be made simpler. Well, there is definitely a place in this world for newer and better software for packet radio operation. On the other hand, I think that most hams can handle learning how their TNC works.

I am afraid for amateur radio when I hear people talking about how difficult amateur radio is, and how we must make it simpler so more people can enjoy it. Hogwash! Amateur radio is a technical hobby. Amateur radio is where people who are interested in radio technology go to engage in their interest. You have to learn new things to be a part of amateur radio. If you are willing to learn, there are MANY hams out there willing to teach. It will probably cost you no more than the cost of gas to get to a club meeting or perhaps lunch when they come over to your house to help you set up your station. After that you can share your newly acquired knowledge by helping someone else learn something new.

I want to thank Joe for his well thought out letter. He also included a program for the PC which I haven't had a chance to try yet. When I do, I'll let you know how it turns out.

The TAPR PacketRADIO

At Dayton in 1989 TAPR showed off their proposed PacketRADIO. PacketRADIO is going to be a kit that combines both the TNC and a 2m transceiver in one package. The nice thing about the PacketRADIO is that it will provide both 1200 and 9600 baud capability. The PacketRADIO will be a kit along the lines of the original TAPR TNC.

TAPR has had quite a time getting the PacketRADIO done and into the hands of amateurs. At Dayton last year I signed up to be a beta tester. This means that if they choose to use me I will receive one of the early kits, which I am obliged to construct and use so that I can provide feedback to TAPR. With feedback, they can possibly improve the production version. The TAPR PacketRADIO is a significant step toward better and faster packet radio.

I will keep you posted on the PacketRADIO saga. If you want more information on PacketRADIO, or if you want to join TAPR, write to: Tucson Amateur Packet Radio, PO Box 12925, Tucson AZ 85732, or call (602) 323-1710. I am sure that they would be glad to hear from you.

The Hint Department

The other day I put up a new antenna, so I was checking to see what I could hear. I noticed a ham spending quite some time perusing the local BBS. While he was doing that, a number of other stations attempted to connect but couldn't because the BBS was busy. This prompted me to share my technique for getting on and off the BBS in as little time as possible.

The process that I use involves doing most of the work off-line, e.g., while I am not connected to the BBS. First I turn on a capture file in my terminal program. This causes everything that comes in from the TNC to be stored in a disk file on my PC. Next I connect to the BBS and give the RM (read mine) command to get all my mail. I then use the L (list) command so that I can see all the bulletins that have come in since the last time I connected to the BBS. As soon as the BBS has transmitted my mail and the list of messages/bulletins, I disconnect from the BBS so that others can use it.

Now I take all the time I want to read my mail, and I prepare answers in another file complete with all the commands to enter and send the mail. If I got a letter from W6ABC @ WB6XYZ and from KA3ZZ @ KA9Q I would enter something like the following into my send file:

```
sp w6abc @ wb6xyz
new software
Thanks for your note. I will include
your suggested feature in the new
software.
73 de Brian, WB6RQN @ K3MC
/ex
sp ka3zz @ ka9q
meeting
Thanks for reminding me of the
meeting. I will see you there.
73 de Brian, WB6RQN @ K3MC
/ex
b
```

Now I connect to the BBS again and use the file transmission feature of my terminal program to upload my send file to the BBS. You will note that the file contains all of the commands to send the mail (the 'sp' or 'send private' commands) and to disconnect from the BBS again (the 'b' or 'bye' command). This ensures that I will be connected to the BBS for the shortest time possible.

To read the bulletins, I use a similar technique. Let us assume that I want to read messages (bulletins) 1924, 1927, and 1939. I prepare a send file containing the commands to read the desired messages like this:

```
r 1924
r 1927
r 1939
```

Then I connect to the BBS, transmit the read commands, and open a capture file to store the bulletins.

Note that the 'b' (bye) command is not included here. If you include it, you will lose part of the last message—the BBS closes the connection as soon as it receives the 'b' command. It doesn't wait until all of the message has been transmitted.

Try this technique out for yourself. You will find that you end up spending less time connected to the BBS. If everyone does this, the BBSs can support more users. 73

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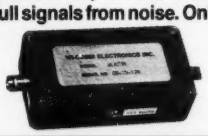

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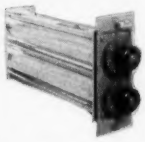

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JUN 30–JUL 1

WESTON WV The West Virginia State Convention, sponsored by the West Virginia State AR Council, will be held at the Jackson's Mill State 4-H Camp near Weston. Doors open Friday for dealer set-up from 5:30 PM–11 PM and open to the public at 9 AM Saturday and Sunday. Admission is $5. Flea market tables free. Ticket required. Equipment auction Saturday evening. VE exams 8 AM Saturday. Pre-registration required. Deadline June 23. Contact *Bob Robinson KU8C, 304–366–0132*. Camping available. Talk-in: 144.79/145.39. For advance tickets contact *Sue Goodwin N8JNL, 103 Cleveland Ave., Nitro WV 25143*. For info, contact *Chuck McClain K8UQY, 304–366–5401*.

JUL 1

WILKES-BARRE PA The Murgas ARC will hold its annual Ham/Computerfest at the ICE-A-RAMA Coal St. Sports Complex. Set-up 6 AM. General admission 8 AM. Advance tickets $3, $4 at opening. XYLs and children under 16 free. Tailgating $3. Free parking. Indoor tables $10. Reserved space will be held until 0830 unless paid for in advance. Bring your own extension cord. Talk-in: 53.81, 53.61, 146.52, 146.61, 444.825, 10 GHz. To register for FCC exams write: *Joe Caffrey W3DZH, 79 Kellers Lane, Plymouth PA 18651*. For info contact *K3SAE–KB3GB, Rd. 1 Box 214, Pittston PA 18643. 717–388–6863*.

JUL 4

HARRISBURG PA The Harrisburg RAC will sponsor their July 4th Firecracker Hamfest at the Bressler Picnic Grounds. Set-up for vendors and tailgating at 6 AM. Opening at 8 AM. Admission $3, tailgating $3. Tickets in pavillion $10 in advance or $12 at the site. Talk-in: 147.30/.90 or 52/52 simplex. Contact *Dave Dormer KC3MG, 717-939–4957* for reservations.

JUL 7

WEST DES MOINES IA The Des Moines Radio Amateur Assoc. will hold its 1990 Hamfest at the Sacred Heart School. Contact *Harold Ober N0HZK, 515–289-1330*, or write *Hamfest 90, Des Moines Radio Amateur Assoc., PO Box 88, Des Moines IA 50301*.

BURLINGTON ONTARIO The Ontario Hamfest '90 will be presented by the Burlington ARC at the Milton Fairgrounds starting at 9 AM. Set-up at 8 AM. Commercial vendors please use the North gate. Free flea market space. General admission: Adults $5, spouse $3, children under 12 years free; please use the south gate. Contact *Rick Jones VE3WRJ, 639–0724 or Ted Barrette VE3TED, 639–5878*.

OAK CREEK WI The South Milwaukee ARC Inc. will sponsor Swapfest '90 at American Legion Post #434 from 7 AM–2 PM. Free overnight camping. Admission $4. Talk-in: 146.580 MHz FM simplex and most local repeater frequencies. Map and details from *The South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102*.

JUL 7–8

INDIANAPOLIS IN The Indianapolis Hamfest and Central Division AARL Convention will be held at the Marion County Fairgrounds. Advance tickets $6 with SASE. $8 at gate. Mail request for advance tickets to *Indianapolis Hamfest, PO Box 11776, Indianapolis IN 46201*. Free camping and hook-ups supplied on a first-come basis. Gates open at 6 AM each day. Commercial and inside flea market booths; plenty of outside flea market space.

JUL 8

DOWNERS GROVE IL The DuPage ARC is sponsoring the eighth annual Hamfest and Computer Mart at the American Legion Post #80, beginning at 8 AM. Dealers indoors, flea market and tailgating outside. Free parking. VEC exams. General admission $2 in advance, $3 at the gate. Talk-in:146.52 –600. For tickets and table reservations, SASE to *Hamfest Chairman, DuPage ARC, Edwin Weinstein WD9AYR, 7511 Walnut Ave., Woodridge IL 60517*. For info call *Ed, 708–985–0527 evenings*.

PITTSBURGH PA The North Hills ARC will hold its 5th Annual Hamfest at the Northland Public Library from 8 AM–4 PM. Free admission. Free dealer tailgating space. Free parking. Handicap facilities. VEC testing at 8 AM. For VEC info send SASE to *John Rosenwald NM3P, 400 Stevens Dr., Pittsburgh PA 15237. 412–931–2651*. Please pre-register. Send SASE for Hamfest info to *Bob Ferrey, Jr., N3DOK, 9821 Presidential Dr., Allison Park PA 15101. 412–367–2393*.

JUL 13–15

NORTH DAKOTA-MANITOBA North Dakota and Manitoba's biggest Hamfest will be held at the Peace Garden on the USA/Canadian border a few miles North of Dunseith ND, and a few miles south of Boissevain Manitoba. Registration will start Friday afternoon. Breakfast for all on Sunday morning. Outdoor flea market. Contact *John A. Swanke KA0SLI, Box 304, Lakota ND 58344*.

JUL 14

EAU CLAIRE WI The Eau Claire ARC will hold its annual Hamfest at the 4-H buildings behind Highland Mall from 8 AM–2 PM. Free parking. Tables $3, dealers $5. Admission $3. Packet meeting at 10:30. Exams from 9 AM–1 PM, all walk-ins. Talk-in on the Eau Clair 31/91 repeater. For table reservations contact *Liz Searing N9EQR, 1129 McKinley Rd., Eau Claire WI 54703. 715–834–1303*.

JUL 15

WASHINGTON MO The Zero Beaters ARC will hold its annual Hamfest at the Bernie H. Hillerman Park Washington Fairgrounds. Flea market parking $2 a space. Free admission. Walk-in VE exams begin at 10 AM. Talk-in: 147.24 repeater. Contact *Dane Brockmiller, Rt. 2 Box 623, Union MO 63084. 314–583–2323*.

LAKEWOOD CO The Denver Radio Club is holding its annual Hamfest and the ARRL Colorado State Convention at the Jefferson County Fairgrounds. Talk-in: 147.33/.93 and 146.52. Contact *Keith N0LSL at 303–680–0862 or 303–790–4001* or *John KA3RDZ at 303–340–8698 or (340)–980–2957*.

AUGUSTA NJ The Sussex County ARC will Sponsor "SCARC '90" at the Sussex County Fairgrounds beginning at 8 AM. Registration, $4 (XYLs and harmonics free). Indoor tables $7. Tailgate space $5. Free parking. For further info contact *Don Stickle K2OX, 185 Weldon Rd., Lake Hopatchong NJ 07849. 201–663–0677*.

JUL 20

VERONA NY The Madison-Oneida ARC is holding VE exams at the Madison-Oneida BOCES beginning at 7 PM. Novice through Extra. Technician through Extra class tests cost $4.95. Talk-in: 145.37. Contact *Leonard Popyack WF2V. 315–853–8974. WF2V can also be reached on 146.79, 145.37, WF2V @ WA2TVE, or POPYACK@TOPS20. RADC.AF.MIL*.

JUL 21

KNOXVILLE TN The RACK Volunteer Examiner Team is holding VEC exams at the Pellissippi State Technical Community College, Bldg. B, Room 129, beginning at 10 AM. To pre-register, send SASE and check for $4.95 to *WCARS/VEC, Ray Adams N4BAQ, 4325 Felty Dr., Knoxville TN 37918*.

JUL 22

VAN WERT OH The Van Wert ARC Inc. will hold its 3rd annual Hamfest/Computer Show at the Van Wert County Fair Grounds. Free parking. Tables are $6 each (8' x 30"). Bring your own extension cords. Outside sales are as follows: One $4 permit entitles you to one vehicle and 10' frontage. Bring your own tables. Please contact *Bob Barnes WD8LPY, 419–238–1877* or *Jack Snyder WD8MLV, 419–495–2209*.

JUL 26–29

WICHITA KS The Central States VHF Society will hold its annual convention at the Marriott Hotel. Room reservations should be made directly with the hotel. For info contact *Lonnie Roberts WD0L, 628 Elaine, Clearwater KS 67026. 316–584–6465*.

JUL 28

GOWANDA NY The Tri-county ARS is holding its 2nd Annual Hamfest at the Gowanda American Legion Post #409, beginning at 7 PM. Admission $4 per person. Talk-in: 145.39 K2XZ repeater. Contact *Andy, 716–532–2250*.

JUL 29

TIMONIUM MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State Fairgrounds. Kids under 12 free. 8' tables with power access are $40 each or 4 for $150 in the Main Exhibit Hall. Tables in the Home Arts Building (no power) are $20 each or 8 for $150. Dealer set-up begins Saturday at 2 PM, Sunday at 6 AM. There is no set opening hour. Tailgating is $5 per vehicle space, for sale only on the day of the Hamfest. No advance reservations for tailgating. Free VE exams begin at 10 AM. Pre-registration required. Talk-in:147.03/+, 443.4/+, 224.96/–. For info and reservations write *BRATS, PO Box 5915, Baltimore MD 21208. 301–583–9147*.

PEOTONE IL The Hamfesters Radio Club will host its 56th Annual Hamfest at the Will County Fairgrounds from 6 AM–3 PM. Donation $4 advance, $5 at the gate. Children under 12 years free. Set-up is Saturday from 6 PM–12 midnight. Opening is at 6 AM Sunday. For advance tickets send SASE & check to: *Don Burch N9DWI, 8438 S. Kolin Ave., Chicago IL 60652. 312–582–9776*. Reservations close July 15th. Talk-in: 146.16/.76 CFMC repeater.

AUG 3–5

JACKSON HOLE WY The Eagle Rock ARC will sponsor the WIMU '90 Hamfest at the Virginian Lodge. Advance tickets $10, $12 at the door. Talk-in: 146.31/.91. Send registration to: *WIMU '90, PO Box 2415, Idaho Falls ID 83403-2415*. Make checks payable to WIMU '90. For info contact *Doug Smith WA7PYO 208–529–5121 days, 208–529–1504 evenings*. For reservations at Virginian Lodge *800–262–4999*; mention the Hamfest.

SPECIAL EVENT STATIONS

JUN 30

ALFRED NY Special Event Station W2RUI will be operated from the Artist Blacksmith's Assoc. of North America 1990 International Conference from 1400Z–2200Z. Frequencies: SSB 7.275, 14.275, 21.375 and 28.375. For certificate send QSL and large SASE to: *KA2LCR, 6562 Royal Parkway South, Lockport NY 14094*.

JUL 1

KOKOMO IN Special Event Station N9IPA will be operated from the Haynes-Apperson Automobile Festival between 1300–2100 UTC in celebration of the testing of the first commercially successful automobile by Elwood Haynes on July 4, 1894. Frequency: 28.450 MHz ± QRM. Send a SASE with card and QSO number to: *Wildcat ARS, 1745 S. Indiana Ave., Kokomo IN 46902*.

JUL 7–8

KALAMAZOO MI The Kalamazoo ARC and the Southwest Michigan AR Team will operate Special Event Station W8VY from 1300Z–2200Z at the High On Kalamazoo Airshow to demonstrate amateur radio to the public. Frequencies: 10m and 2m. For a certificate, send QSL and SASE to *W8VY, c/o Jack Price KA8AOB, 1511 Center St., Kalamazoo MI 49001-1859*.

JUL 8–14

CATALINA ISLAND CA Special Event Station WA6QPZ will be operated from the Emerald Bay Boy Scout Camp from 1500–0700 UCT daily, to commemorate the Boy Scouts' use of Emerald Bay since 1925. Frequencies: 28.45, 14.30 and the General portion of the 15m and 40m phone bands. CW operation will be around 7125 kHz and 21150 kHz. Contacts send a QSL card and a 9x12 SASE to *Marshall Jacobson, 16441 Gilmore St., Van Nuys CA 91406*, for a certificate.

JUL 13–14

US/CANADIAN BORDER Special Event Station VE4IHF will be operating from the International Peace Garden from 9 AM–6 PM CST. Frequencies: 80m 3.941, 40m 7.255, 20m 14.255, 15m 21.365, 10m 28.355. We will be using the higher frequencies if they are open. For a Peace Garden certificate, send 2 IRC and an SASE to *Dave Snydal VE4XN, 25 Queens Crescent, Brandon, Manitoba Canada R7B 1G1*.

JUL 14

BELLE PLAINE MN The Soutwest Metro ARTS will operate WB0RMK from 1500Z–2100Z in celebration of B-B-Q days. Frequencies: 7.245, 14.245, 28.345. Send QSL and SASE to: *WA0CXW, Secretary of SMARTS, PO Box 144, Chaska MN 55318*.

JUL 14–15

ANAHEIM CA The Disneyland ARC will operate Station N6MM from 1600Z–1400Z in celebration of its 35th year as the world's premier theme park. Frequencies (±QRM): 20m 14.260, 15m 21.335, 10m 28.450, 2m 146.94 (Disneyland repeater). For a special QSL card send QSL card with QSO number and one first class postage stamp for the return card to *Disneyland ARC, PO Box 3232, Anaheim CA 92803*. For more info contact *John Thompson K6OHM, 714–520–2240*.

JUL 21–22

PICO RIVERA CA The Northrop Radio Clubs at Pico Rivera and Hawthorne, W6VPZ/6 and W6VPZ, will operate 24 hours from 1100 PST 21 July–1100 PST 22 July, to celebrate the anniversary of the first flight of the B-2 Advanced Technology Bomber and the 51st year of Northrop's building airplanes. Frequencies: 25 kHz from the lower band edges of the Novice and General bands (10, 15, 20, 40, and 80) and 1.920. For QSL send to *Northrop Radio Club W6VPZ/6, 8900 E. Washington Blvd., Pico Rivera CA 90660, and Northrop Radio W6VPZ, One Northrop Ave., Hawthorne CA 90250*.

JUL 24

CASPER WY The Casper ARC will operate Station W7VNJ from 1500Z–2300Z to commemorate the Wyoming Centennial Celebration. Frequencies: 14.300, 21.300, and 28.400 (±QRM). For a centennial QSL please send a SASE to: *Casper ARC, PO Box 2802, Casper WY 82602*.

JUL 27–29

WESTOVER AFB MA The Mount Tom ARA will operate WA1KGR between 1300Z–2000Z, during the Open House, to commemorate the 50th Anniversary of the base in Chicopee MA. Frequencies: 28.425 MHz and local 2 meter packet. For QSL card and certificate send a #10 SASE with QSL card and contact # to *WA1KGR, PO Box 2, Westover AFB MA 01022-5000*.

GILROY CA The Gabilan ARC will operate Station KG6GF from 1600–2400 UTC to commemorate the 12th Annual Gilroy Garlic Festival. Frequencies: 14.260, 21.360, and 28.360. For a certificate and QSL card send SASE to *GARC, PO Box 2178, Gilroy CA 95021-2178*.

JUL 28

HOBBS NM The New Mexico Dist. Royal Rangers will operate Station KD5RZ from 1300–0100 UTC. Frequencies: 3.870, 7.250, 14.250, 21.320 and 28.520/28.380. For certificate send QSL and large SASE to: *KD5RZ, c/o 2214 Thomas, Hobbs NM 88240*.

JUL 28–29

AURORA CO The Colorado Six Meter Invitational Net is sponsoring an Activity Day Contest from 1400Z July 28–0300Z July 29. Make contacts on 50MHz, exchanging callsign, first name, grid square and S.I.N. number (if any). S.I.N. members count for 3 points, non members for 2 points. For score, multiply number of grid worked by number of points logged. First and second place winners will receive certificates. All contest operators sending in their scores will receive results of the scoring. Send logs, including date and time of QSOs along with SASE by Aug. 31 to: *Clay Schneider KA0MKF, 1034 S Ventura Way, Aurora CO 80017*.

JUL 28–31

OSHKOSH WI The Fox Cities ARC will operate Special Event Station W9ZL from the 38th Annual International Experimental Aircraft Assoc. Fly-In & Convention, primarily during daylight hours. Frequencies: General portions of the 10, 15, 20 and 40m bands in as many modes as possible. All QSLs must include contact numbers. Special certificates will be issued for proper QSLs. Send 8x10 SASE to: *Wayne Pennings WD9FLJ, 913 N. Mason St., Appleton WI 54914*.

JUL 30–AUG 3

CANTON OH The Canton ARC will operate Station W8AL from 2200–0200 UTC July 30–August 3, and from 1700–2300 UTC on Aug 4–5, to celebrate the Pro-Football Hall of Fame Greatest Weekend. Frequencies: SSB 28.350, 21.350, 14.270, and 7.270; CW 28.150, 21.060, 14.060, and 7.060. RTTY, packet, AMTOR, and 2 meter FM operation also. SWLs welcome. For an unfolded certificate, send your QSL and a 9x12 SASE with 2 units of first class postage. For a QSL or folded certificate, send your QSL and a #10 (business size) SASE to: *Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306*.

JUL 30–AUG 4

GRAND HAVEN MI In conjunction with the 1990 Coast Guard Festival, commemorating the 200th Anniversary of the Coast Guard, the North Ottawa ARC will operate KE8DL from 1500Z–2300Z. Frequencies: lower 25 kHz of 40m and 20m and between 28.400 to 28.450. Contact any NOARC member during the week and those contacts will also be recognized. For certificate send QSL and #10 SASE to: *KE8DL, 1915 Hillcrest, Grand Haven MI 49417*.

AUG 1–4

WILDWOOD NJ The U.S. Coast Guard Electronics Engineering Center, in cooperation with the Cape May County ARC, will operate Station K2CGD to celebrate the 200th anniversary of the Coast Guard's founding, from 2000Z–2359Z on Aug 1st–3rd and from 1200Z–2359Z on Aug. 4th. Frequencies: Phone 28.375, 21.375, 14.300, 7.235 and 3.875; CW 21.175, 14.100, 7.110, 3.710. For a QSL and certificate send a 9x12 SASE and QSL to *K2CGD, USCG EECEN, PO Box 60, Wildwood NJ 08260*.

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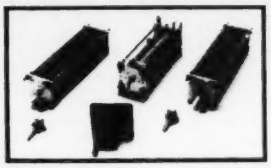

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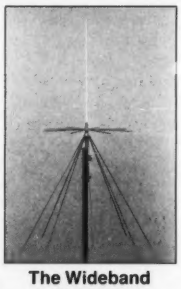

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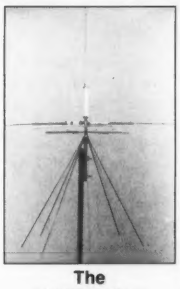

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Switching Power Supplies

This year the Southwest Division ARRL Convention is being held in the San Diego area on August 26, at the Town and Country Convention Center very near my home. The San Diego Microwave Group will participate in the assembly of a "VHF through Light" session organized by Kerry Banke N6IZW and Ed Munn W6OYJ. Papers and demonstrations on 144 MHz through Laser, or blue light frequencies, are being sought for the convention presentation.

Ed expects that most attendees will already be interested in VHF to microwave operations. However, because the audience will have diverse interests, we don't want to get wrapped up in equations when proposing topics for technical discussion. Informative topics describing various aspects of our amateur spectrum and its uses would be helpful in describing the microwave spectrum.

I can't wait for the convention to start. Being a surplus scrounger, the flea market is my opportunity to check out bargains and find new items for projects. Meeting old acquaintances I haven't seen in a long time will also be very enjoyable. Any time you can mix a ham convention, old friends, and surplus scrounging it has got to be a happening. In any case, the convention should be so full of activities and varied interests, you don't want to miss out. See you at the flea market or on the grounds.

FETs

Lately surplus scrounging in the San Diego Area has turned up a large quantity of high power enhancement mode HEXFETs™ (International Rectifier Corp.). This surprised me since they are a recent development. Usually when you locate items like these, they're just a few devices on a PC board, not a bag full.

FETs, field-effect transistors, have been around for a long time, but devices capable of handling high power, being relatively new, are not common in the surplus market. They're primarily used in switching power supplies and control circuitry. When first introduced, the cost per FET was quite high; now they are less than $10 each.

The power FETs are quite special, representing a technological jump in high speed switching components. What makes the power FET so superior to a power transistor is that it does not need gate current to drive the device. The gate structure, insulated from the drain and source, looks like a capacitor to the driving circuit. Because current is not needed to turn on the device, speed is increased by not having to wait for circuit current to discharge. Only voltage is used to control the gate structure in a power FET.

Disadvantages in a Transistor

Base current in a transistor is referred to as a minority current which causes a majority current flow between the collector and emitter. Restated, to turn on a transistor you forward bias the base and minority current flows, base to emitter, and cause the emitter collector current to flow (majority current).

This causes an offset voltage due to the diode junctions of the transistor. As current increases, the power/heat in the junction increases rapidly due to the voltage drop. The minority current severely limits the switching time in a transistor and gets worse as the current increases, heading for thermal runaway.

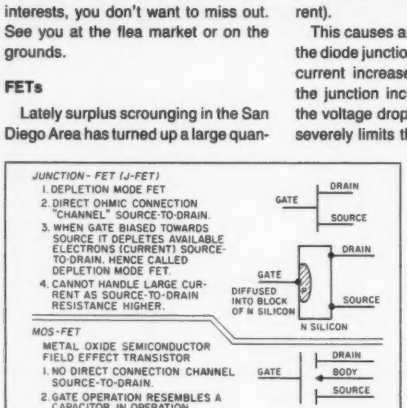
JUNCTION- FET (J-FET)
1. DEPLETION MODE FET
2. DIRECT OHMIC CONNECTION "CHANNEL" SOURCE-TO-DRAIN.
3. WHEN GATE BIASED TOWARDS SOURCE IT DEPLETES AVAILABLE ELECTRONS (CURRENT) SOURCE-TO-DRAIN. HENCE CALLED DEPLETION MODE FET.
4. CANNOT HANDLE LARGE CURRENT AS SOURCE-TO-DRAIN RESISTANCE HIGHER.
GATE
DRAIN
SOURCE
DIFFUSED INTO BLOCK OF N SILICON
N SILICON
MOS-FET
METAL OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTOR
1. NO DIRECT CONNECTION CHANNEL SOURCE-TO-DRAIN.
2. GATE OPERATION RESEMBLES A CAPACITOR IN OPERATION.
3. FET OPEN SOURCE-TO-DRAIN "MEGOHMS" WHEN GATE OPEN OR CONNECTED TO SOURCE.
4. WHEN GATE BIASED HARD POSITIVE OR TOWARD DRAIN CAUSES CHANNEL TO OPEN BELOW GATE STRUCTURE BY ATTRACTION OF ELECTRONS ⊖.
5. VERY HIGH CURRENT POSSIBLE SOURCE-TO-DRAIN AS RESISTANCE EXTREMELY LOW.
GATE CONTACT WITH OXIDE INSULATION (SHOWN BLACK)
BODY
INVERSION CHANNEL AREA
P SILICON

Figure 1. Comparison of low power JFET (junction field-effect transistor) and high power MOSFET (metal-oxide-semiconductor FET).

Why FETs and not Transistors

Because FETs do not require drive current, speed is greatly enhanced. Very high currents can be controlled from a simple drive source. TTL, transistor-transistor logic, is typically the method (with additional driver) used to drive a power FET or CMOS (complementary metal-oxide semiconductor) directly. The CMOS can drive power FETs because they operate at the required 10 volts, fully saturating the gate to deliver maximum switching speed. (Most CMOSs will operate to 20 volts maximum).

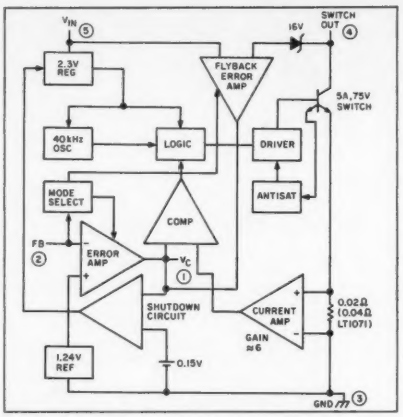

Figure 2. The LT-1070 switching regulator, current mode selector. Linear Technologies.

Operation of a Power FET

A power FET gate (enhancement mode) will turn on when the voltage is raised toward the drain and is above 2.5 volts, a valid TTL high (+2.5 to +5 volts). However, best switching times are made when the FET is saturated at the 10 volts drive level. Interestingly, unlike a power transistor which requires base current to turn on the emitter collector path, the HEXFET gate is controlled by a potential. The source to drain does not have a diode junction, and when turned on, it has a low resistance resulting in almost zero offset voltage.

The switching speed is greatly increased because of the near zero gate current (nanoamps) required to turn the FET on. The gate of these FETs looks like a very large capacitance to the driving circuit. To overcome this capacitive effect, you need two to three CMOS gates parallelled. The result is a good squared waveform on the FET's gate, allowing very fast switching. This extra circuitry is a small price to pay for high switching speeds.

As I said, the FET can switch impressive currents. The IRFP 140 is rated at 100 volts at a maximum of 31 amps, or 180 watts dissipation. The *on* resistance between source to drain of this FET is 0.077 ohms, when *off* is a few megohms. Compared to a transistor's time lag in turning off, the FET is so fast it's either on or off.

You might ask what this has to do with a microwave column. Most equipment for microwave use (solid state) does not operate from the standard negative ground 12 volt automobile power systems. Surplus microwave equipment usually operates from a positive ground, negative 24 volt power source. This is typical of the surplus "brick" type oscillators which make operation on stable SSB microwave so easy. Typical surplus microwave hardware was made for commercial telephone power, which is negative 24 volts.

In the ham shack this is not a problem. The problem arises when you try to obtain −24 volts in the field with +12 volt automobiles. Several operators overcome this difficulty by using batteries in series to obtain −24 volts. However, power supply systems can be made by running everything off of a standard positive automobile battery.

I was really excited when I located the surplus FETs. This gave me the opportunity to design a CMOS circuit for a driver as part of a power converter. The FETs can be switched with very high efficiency using a small toroid transformer at, say, 60 to 100 kHz. This would convert +12 volts input to an isolated 24 volts of whatever polarity you desire on the secondary at high current. Voltage ratios can be custom-wound to suit your requirements. Currently I am looking for a good core to wind my test transformer on, and I'll pass on the information as soon as I complete the project. I will try to wrap up the project and present the details next month. If all works out, I should have a kit with the board and key parts available.

Linear Technologies LT-1070

You can use other circuits for voltage multiplication and polarity reversal. The device that comes to mind

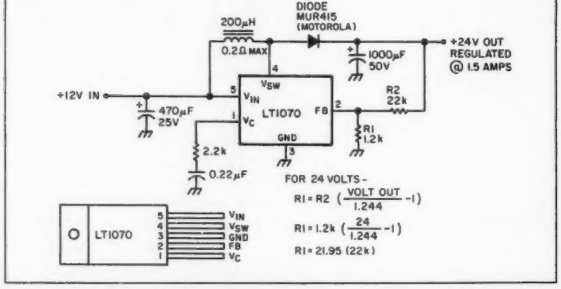

Figure 3. The LT-1070 positive boost switcher. +12V in and +24V out.

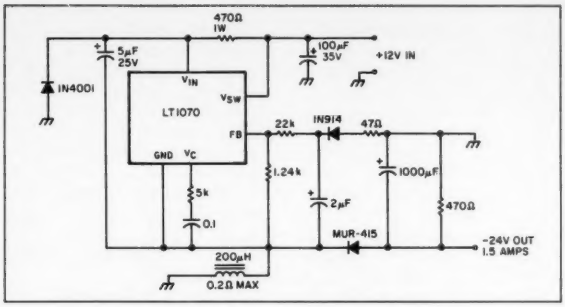

Figure 4. The positive to negative buck-boost converter of the LT-1070. +12V in and −24V out.

is the LT-1070 from Linear technologies. See Figure 2 for details. The normal circuitry for this switching mode power supply is not complicated, but it does use a few unusual components common to switch mode power supply designs. The inductor is a high current type, and as such needs to be wound with large diameter wire for low resistance. I made mine on a ferrite rod with #14 wire. Checking it out on an inductance meter, I adjusted the turns until I got 200 µH. (Note: 40 to 50 turns #14, three layers, on a 1-½" long, ⅜" diameter ferrite rod.)

The other unusual component is the rectifier. 1N4001s will just not work here! You need high speed switching rectifiers. You may be able to find a suitable source for these diodes in surplus switching power supplies and save a few dollars. Besides the LT-1070, the rest of the components are standard.

The heart of the switcher is the LT-1070, which has the oscillator, control, and protection circuitry all in a single chip package. Applications include a battery up-converter (200 watts), and power inverter with positive/negative or fully floating outputs. In our microwave application, we need negative 24 volts from a single 12 volt automobile battery system. I have shown both positive and negative applications. See Figure 3 for the positive voltage converter and Figure 4 for the negative converter. Depending on your power requirements you can have either polarity and the components remain about the same, just the circuit is rearranged somewhat to accommodate the conditions required.

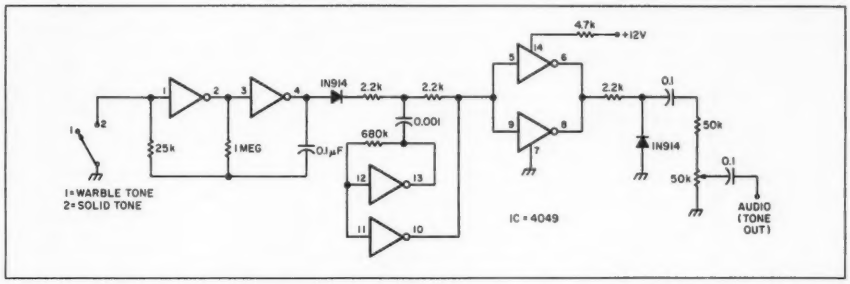

Figure 5. Warble tone oscillator. See the June 1990 column on the programmable CW IDer.

Tone Warbler

Last month I ran out of space (got to watch my ramblings). See Figure 5 for the tone warbler I mentioned for use with the CW EPROM IDer. The tone source is tied into the power supply modulator (adjust the terminal of LM317) that powers the GUNN oscillator. This warbler tone is used on our wideband FM 10 GHz transceivers to assist in locating a signal in the noise. The warble sound is quite distinctive and recognizable in very low signal conditions. This simple circuit works well.

Comments from the Mailbag

Ed K3ZCY reports he is still in the process of converting his commercial 10 GHz transceiver to narrow-band operation. Ed is building an MMIC (microwave modular IC) 2.3 GHz transceiver, and a feed system for a dish he recently obtained. The feed is being built from plans found in *The RSGB VHF/UHF Handbook.*

Abdul Ghaffar Nagaria is trying to locate a source for dish antennas and LNA/LNC satellite receivers. I am sending some information, but due to postage constraints, I can't send him as much as I would like to. Is there anyone close to Abdul who can assist him? His address is Rm #7 2Nd Fl. Bhanji Jagomal Build, Jiven Street Ramsawami, Karachi 325, Pakistan.

Six meter news: Just received a report from Axel N8AXA/M/QRP, stating that he had just completed Mobile WAC on 6 meters QRP. That's 6 on 6 (6 continents on 6 meters). He sent a copy of the contacts, CT1DTQ, DL3ZM/YV5, KL7NO, W6JKV/CT3, JA9IPF, KG6DX, CO2CB, HC1BI, and GMØEWX. Axel was very proud of these contacts and I'm sure that these took lots of planning and plain old good luck. Congratulations Axel N8AXA.

John K2SMZ reports he is building microwave equipment using several of the Solfan type transceivers that he picked up at a New Jersey hamfest. He had two units working on ATV at 50 feet. Currently he is building the 30 MHz IF systems for wide-band FM that appeared in the April issue of *73 Magazine.*

Richard W9RS wants to know if the San Diego Microwave Group publishes a newsletter. Well, Richard, so far we have not put out a newsletter, but if the interest is there we might take another look. Just writing this column takes quite a bit of time, and I am driven by my mail pertaining to microwave and related projects. There are lots of topics, such as the one this month. While not a microwave project in itself, you can apply it to portable microwave operation.

Jim WBØCHL is interested in passing color video on 10 GHz. He wants to know if anyone can provide him with information on expected signal quality. He is looking for firsthand information on systems using simple GUNN transceivers. Commercially, I have passed first rate video on portable microwave systems, but I haven't done this as an amateur. If you have information, contact Jim at 15265 Edenborough Ave, Prior Lake MN 55372.

As always, I will be glad to answer any questions pertaining to microwave or related topics. For a prompt reply please send an SASE. 73 Chuck WB6IGP

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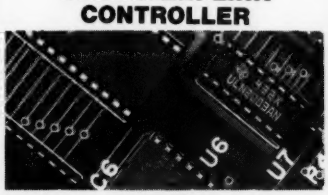

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RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Fourteen Years of "RTTY Loop"

If my calculations are correct, this should be the July issue of *73*. That being the case, this begins the fourteenth year of this column! Fourteen years. . . that's a long time to have been around. We have seen quite a few changes in that time, but don't worry, I don't plan to go into all of them today. What I do want to do is look at what you, the readers of this column, have to say, to ask, and to offer. Because it is what you all have offered in the way of support that has kept "RTTY Loop" looping these many years.

Speaking of looping, one of my, and Wayne's, concerns regards our youth. What they are doing, and how they are doing it, is a common focus of many interests and organizations. To this end, I received a note from John C. White WB6BLV from the Science Department of Lindsay High School, in Lindsay, California. John says his school's amateur radio club is growing in membership, with newcomers to the hobby attracted to the club station's equipment.

I replaced my old station here with a new, modern transceiver. The question of "what to do with the old gear" arose, and here is my answer. Sure, you could sell it, for pennies on the dollar. I guess if you really need the money now, OK. But why not donate it to a school or club near you? That old transmitter, receiver, or even a Model 15 will be received by a group of kids eager to get on the air. Besides the good vibes, there well may be something you can take off your taxes; but be sure to ask a tax accountant or lawyer for advice about that!

Kenwood and ICOM Mods

Interfacing various transceivers to terminal units is always a topic of interest, and from CompuServe comes this tip for Kenwood users. To connect the AEA PK-232 to a Kenwood TS-940, TS-440, or TS-140, use the 13-pin ACC2 connector on the rear.

The hook-up between the Kenwood and PK-232 is diagrammed in Figure 1. The signal level for received data, available at pin 3, is not controlled by the front panel audio potentiometer, so you can feel free to turn that tweedle-dee down. (Makes the wife and kids happy!) Thanks to CompuServe 76702,1013—whatever your name is—for this information.

In a similar vein, Zack Schindler N8FNR in Ferndale, Michigan, passes along this information for modifying an ICOM IC-740 to run AMTOR. According to David Wiegele, a customer service representative at ICOM America, Inc., the IC-740 can work on both HF packet and AMTOR. For HF packet, all that is necessary is to run it through a TNC controller. For AMTOR, you have to make a modification to the unit for the increased (faster) switching time needed for the mode. This modification is shown in Figure 2.

Also, it is desirable to:

- Keep the RF preamp switched off.
- Switch the AVC to "Fast."
- Turn down the RF gain as far as the signal permits.
- Take the AF output from the accessory socket, not from the external speaker socket or headphone jack. This cuts out the internal AF amplifier—these are usually designed to give a slow recovery to avoid thumps in the loudspeaker on change-over.
- In some cases, the antenna relay is slow to release. This is due to the protection diode continuing the current flow through the relay coil. You can cure this by installing a 22-volt zener diode in series with the protection diode (across the relay coil)—this is wired "back-to-back," i.e., cathode of the zener to cathode of the protection diode.

This information is provided as received from ICOM, and I have not personally tried any of it. You could drop them a note at 2380 116th Avenue NE, PO Box C-90029, Bellevue, Washington 98009-9029, if you have any questions.

Help! Help!

Here's a cry for help. Robert C. Dick K6YON has a ROBOT 800 terminal that he has been using for Baudot and ASCII since 1982. He relates that Robot Research seems to have been deleted from the face of the earth. Does anyone know if another firm has arisen to care for these aging beasties? Or will Bob be on his own when his ROBOT cops out? If you know, drop him a line at 1534 Sunset Hill Drive, West Covina, CA 91791. Be sure to "carbon" me, too, so that we can publish the information for others.

While we're asking for help, here is another plea. Buren Eagle W6VXI has a long history of RTTY interest, with all kinds of mechanical monsters. He is now trying to computerize, and he has a C-64 computer, Kantronic HamText program, and a Flesher TU-300 terminal unit. He has been unable to interface the C-64 with the Flesher and wonders if anyone can be of service. Anyone? With the popularity of these items in the RTTY community, I find it hard to believe that someone has not already invented this wheel. Why not roll Buren the information, at 309 Coronado Drive, Petaluma, CA 94954, and of course, send me a copy!

Mod and Demod

Last April, I realized that since I was first licensed in 1964, I had reached the twenty-five year mark, thus qualifying me for the Old Timer's Club! Imagine, me. . . an old-timer? This came to light with a letter received from Allen L. Barnett WB2QPM, who gives a little history of the word "modem" we so often throw around in this column.

Al tells us that this word originated with the carrier telephone equipment designed by Bell Labs and built by Western Electric many years before computers. As Al puts it: "In the late 1930s I was involved with the then new 'C-carrier' equipment being installed on the open wire lines that then crossed much of the country. We thought it a really great advance—state of the art! It added three carrier channels to the existing voice frequency channel, for a total of four channels per wire pair. The combined balanced modulator and demodulator panel in the terminal bay was known as the MODEM. Transmission was by SSB. . . [as well as by] the AT&T overseas radiotelephone circuits—including the impressive installation at Lawrenceville, New Jersey, where the acres and acres of rhombics would give any ham visions of what Heaven must be like!"

Well, all I can say is that the word "modem" is, of course, a contraction of MODulator and DEmodulator. Where it comes from, I leave open to the next entry!

RTTY.BAS Program

I've received a few questions lately about the (in)famous RTTY.BAS program published in the January 1988 column of "RTTY Loop." For those who missed the follow up, here goes. The program, as printed, is WRONG! The typesetting computer at *73* choked on the program listing as uploaded, and changed some operators to rather strange signs. *(Actually, it burped.—Eds.)* You can download the correct program from Delphi's CoCo Forum or CompuServe's HamNet. *(Also see the correction in the September 1988 issue of 73, page 57.)*

You can also ask a buddy who has a working copy of a disk or tape of the program to give you one. You can arrange for someone in your club or school to circulate copies. If all else fails, send me a disk or tape and two bucks, along with a self-addressed, stamped mailer for the return of same, and I will make you a copy. Be patient, though; I am a physician with a paucity of free time. I will try to get it back to you as soon as possible. As of this writing, by the way, I think I am caught up. If you are due a disk or tape back as of April 1990, and you haven't received it by the time this column is printed, please drop me a line. It is entirely possible that somewhere between my mailbox and your mailbox, something screwed up.

By the way, last month's column was on Prodigy, an on-line service. If you want more information about it, you can call (800) 822-6922. Ask for extension 556 for details on obtaining a Prodigy Service Start-up Kit. Packages re also available at most computer stores.

The response on the digitizer columns was quite gratifying, and I look forward to printing more, in future columns, of some of these more recent developments. Requests? Comments? Opinions? Send them along to me at the above address, or electronically on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). 73

Table 1. Kenwood TNC hookup

PK-232	ACC2	
RED	Pin 13	Push-to-Talk line
SHIELD	Pin 12	Ground
WHITE	Pin 11	Transmit data in (PK-232 to Radio)
BROWN	Pin 8	Ground
GREEN	Pin 3	Receive data out (Radio to PK-232)

Table 2. IC-740 AMTOR Modification

Locate the following capacitors in the IC-740:

DC Block:	C17, C15
Reg Block:	C4, C5
Main Unit:	C16, C125, C84
RF Unit:	C133, C122

Decrease these capacitors to 1/5 of their original value.

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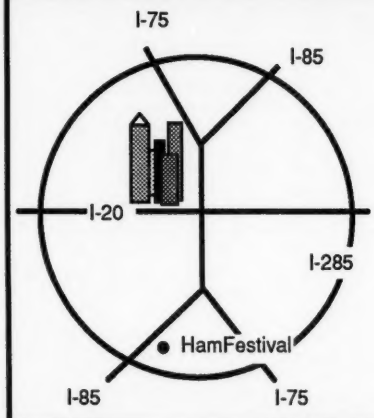

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171	172	173	174	175	176	177	178	179	180	371	372	373	374	375	376	377	378	379	380
181	182	183	184	185	186	187	188	189	190	381	382	383	384	385	386	387	388	389	390
191	192	193	194	195	196	197	198	199	200	391	392	393	394	395	396	397	398	399	400

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Hams Around the World

Bob Winn W5KNE
c/o QRZ DX
P.O. Box 832205
Richardson TX 75083

Soviet Special Event and Contest Callsigns

In last month's column we discussed Soviet callsigns in some detail, including their structure and how to determine in which oblast the station is located. But, we left the subject before discussing special event and contest callsigns and one other class of callsign issued to old-timers.

During the past few years some old-time amateur radio operators have been given permission to abbreviate their prefix to a single letter, followed by the digit and regular suffix. U5FG, ex-UE5FG, is one of these. In the majority of cases these old-timers had callsigns that were issued many years ago when each republic was represented by a specific double letter and digit combination which identified the republic: UA1-6, UA9-0, UB5, UC2, UD6, UF6, UG6, UH8, UI8, UJ8, UL7, UM8, UO5, UP2, UQ2 and UR2. Most of these old-timers are listed in the Callbook under their old callsign. In most cases the location of these old-timers may be identified by using the digit and first letter of the suffix. As a general rule, a callsign with a single letter prefix may be deciphered as follows: R9AMO = RA9AMO, U6GA = UG6GA, U6FA = UF6FA, etc. Note that U6GA and U6FA were not previously UA6s, because according to the oblast list that you no doubt have purchased, there were no UA6F or UA6G callsigns listed.

Each year during May many Soviet amateur radio operators celebrate the anniversary of the victory of the U.S.S.R. in World War II by operating with special "E" prefix callsigns, which are not structured in the normal fashion. These special event stations, using the prefixes in the series EM, EO, ER, EU, EV and EW are in the following categories: EM—stations located in former capitals of guerrilla activity; EO—stations in cities that were awarded medals for their contribution toward victory; ER—ER3A located in Moscow; EU—stations in capitals of the 15 Soviet republics; EV—stations in capitals of Soviet autonomous republics (ASSR) and EW—stations located in "hero cities."

The prefix does not identify the DXCC country of these victory celebrants, but the QSL manager usually does. The QSL manager in 99% of the cases is the normal callsign of the station in question. Otherwise, a few simple rules will let you unravel the mystery of these callsigns. The first or only letter of the suffix identifies the second letter of a normal prefix: A = UA, C = UC, H = UH, I = UI, etc. For oblast collectors, in the callsigns with two or three letters in the suffix, the second letter of the suffix usually identifies the station's oblast. Example: EM0COG was located in the Byelorussian Republic (UC), more specifically, in the oblast identified by UC#O. Other examples: EO4AHK (UA4H), EV4AY (UA4Y), EU4F (UF), EU7L (UL), EO8I (UI), EM8CCM (UC#C) and EU3A (UA3 Moscow).

There are other special event and contest callsigns that are fairly easy to understand, such as U0Y, the abbreviated form of UA0Y. In the case of RX0C the digit and first letter of the suffix identifies the location as Asiatic Russia and specifically as the Khabarovskij Oblast (operated from club station UZ0CWA).

There are some special callsigns that are not easily deciphered, but you can make an educated guess or two. Several recent contest operations using prefixes in the "EX" series were probably located as indicated: EX9S (UA9S), EX1A (UA1) and EX8M (UM8). Getting the QSL manager of any one of these would provide the needed clue.

Callsigns in the 4K series are assigned to stations located outside of continental U.S.S.R.: 4K0—stations located on floating ice islands (Arctic), 4K1—Antarctica, 4K2—Franz Josef Land, 4K3—European Arctic islands, except Franz Josef Land, and 4K4—Asian Arctic islands.

Quite often callsigns assigned to a special event will provide only general information about the location of the station. In the case of a recent dog sled race the callsigns 4K0AOC, 4K4DR, EK0AOC and EK0DR were assigned. 4K0AOC and 4K4DR operated from islands as indicated from their prefixes, but the exact operating locations of EK0AOC and EK0DR are not identified by the callsigns. However, they were both operating from locations in Asiatic Russia (UA0) as indicated by the zero in the prefix.

Collecting oblasts, awards and understanding Soviet callsigns can be an interesting and challenging sideline for any DXer. The tips described should get you started.

Next month the discussion will continue with callsigns—callsigns galore! 73

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73 INTERNATIONAL

edited by C.C.C.

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

It is now the middle of summer, for some of us at least. Dayton and Deerfield are past history, Field Day as well; many contests long gone and more to come; many more daylight hours to do outside ham things such as antennas, ground wires, and tower work.

Since I didn't make it to Ireland this summer, I guess I get to be part of those who will be doing some of that work myself, such as replacing the tripod holding my CL-33 tribander and 2 meter beam. It has lasted for about 15 years, which I now find very surprising. The tripod was never made for an antenna the size of the CL-33, and two of the three legs were broken from the twisting and the corrosion.

We should all probably check our outdoor equipment more often. If I had been inspecting my antennas and support system more regularly, I probably would have caught the impending problem last summer. I wouldn't have had to climb on the snowy roof in the middle of a New Hampshire winter to wire the thing together, hopefully to hold until spring.

I received a very nice letter from Enrique Leira EA1AZO who reported that we have been using the wrong emblem on the flag of Spain. Instead of an eagle, it should be an escutcheon, or shield of arms. The eagle has not been used for ten years! Though little detail will show, from now on we will have the correct emblem on the flag. We apologize for this error, and thank EA1AZO for pointing it out.

Hopefully you will all have an excellent summer. Enjoy!

—Arnie N1BAC

Roundup

Italy *From I0FHZ, President of the Orvieto Section of the Associazione Radioamatori Italiani.* Section ARI of Orvieto, in collaboration with the Touristic Office of the District of Orvieto, has established a Certificate for the 7th Centenary of Orvieto Cathedral. The period for this certificate is from May 1st to August 15th.

The presentation of the certificates will take place during the 5th "Symposium International Tecnichal Scientific of Experimentation" in Orvieto the 13th and 14th of October. Those unable to attend will receive their certificates by mail.

Contact the ARI for details of the contest at: ARI Sezione di Orvieto, Cas. Post. 3, 05018 ORVIETO (TR), Italy.

Japan *From the JARL News.* As most of us know, JAS-1b was launched February 7, 1990. Shown in this column is a picture of the amateur satellite.

Included in the JARL News was an introductory explanation of the mailbox. The information was too lengthy to be included in the column, but you can find it on the 73BBS in 73 Intl SIG titled JAS-1b.

Scotland *From John "Paddy" McGill GM3MTH, Coordinator of the Scottish Tourist Board (Radio Amateur) Expedition Group.* The Scottish Tourist Board (Radio Amateur) Expedition Group is at it again, operating throughout Scotland and Great Britain, from castles, distilleries, and other locations. *[Yes, I said distilleries!]* By the time you read this, several dates have already passed (April 14/16, May 12/13, June 9/10, and June 16), but others are still ahead: July 15/22 GB2NTS, August 18/19 GB2RB, and September 22/23 GB2NTS. For further information on the Thistle Awards and the Supreme Tartan Banner Award, contact: Paddy McGill GM3MTH, P.O. Box 59, Hamilton, Lanarkshire, Scotland ML3 6DB. *[Or check for STB(RA)EG Awards in 73 Intl SIG on the 73BBS.–Arnie]* Send log extracts to Robbie GM4UQG at the same address.

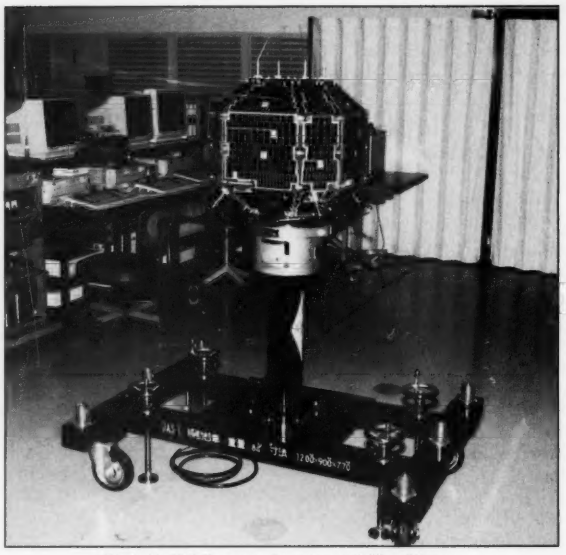

Photo B. JAS-1b, second amateur satellite of Japan.

South Africa *From Gerald Klatzko ZS6BTD, Secretary of the SARL.* The South African Radio League Headquarters moved from Cape Town to Johannesburg in May 1989. For a while, a temporary postal address was used, but now they have a final and permanent postal address: S.A. Radio League, P.O. Box 807, HOUGHTON, 2041, Republic of South Africa.

Switzerland *From the International Telecommunication Union (ITU)* comes a Forum 91 Announcement and Call for Papers.

The World Telecommunication Forum has been held in Geneva, Switzerland, on a quadrennial basis since 1971. The ITU, together with many professional engineering societies from its 166 member countries, is now organizing the Technical Symposium, Part 2 of the 6th World Communication Forum. The Symposium will be held in Geneva from Thursday, October 10 to Tuesday, October 15, 1991, within the framework of TELECOM 91, the theme of which is "An interconnected world: improving the quality of life for all."

A limited number of papers will be accepted for presentation to the Technical Symposium. These papers must be unpublished and based on original research, developments and approaches carried out in the period between TELECOM 87 and 91. They should concern themselves with the technical aspects of telecommunications, technologies, networks and services, giving an overview of the present situation or the direction of research and development for the future. For more information, write Forum 91 Secretariat, International Telecommunication Union, Place des Nations, CH-1211 Geneva 20, Switzerland.

Photo A. Orvieto Cathedral.

LITHUANIA

Jonas Paskauskas LY2ZZ
PO Box 71
Siauliai, 235400
Lithuania

The First Ham Convention which was scheduled to be held in Vilnius in early June *[as stated in the May 1990 "73 International"]* has been canceled or delayed until September, autumn, or maybe even next year. I am sorry that some of you who have already made plans and reservations will have to make changes.

Please bear with us as we attempt to pull our plans back together.

SPAIN

Woodson Gannaway N5KVB/EA
Apartado 11
35450 Santa Mario de Guia
(Las Palmas de G.C.)
Islas Canarias, Espana

Things have been very quiet in the Canary Islands. It has been very nice to meet some ham visitors from the United States.

I just received the information for the ARRL's International Travel Host Exchange program and I think we will register. My station is neither modern nor powerful, and my antennas are pretty limited, but it is my shack, in a small corner of a crowed room often in use for other work, but it is just fine for me. I get on when I feel like it and when I have time.

I don't operate during contests and won't tolerate a pileup. But I do enjoy courtesy and good will on the air. My wife and I both work a full schedule, so there is not too much time to get on the radio. With all this, why am I a ham at all? Well, it's that bit about international friendship that gets me, to meet and talk to interesting people of different backgrounds, and maybe develop a friendship or two along the way.

Well, that's all from here. For the hams on the mainland in Spain, please send me your happenings so that I can include them in my reports.

SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 00 Nykvarn
Sweden

European Common License During the 1980s very successful efforts have been made within the CEPT organization in order to simplify the issuing of licenses to ham operators traveling in other European countries. CEPT, founded after World War II by the West-European telecommunication administrations, stands for Conference Europeenne des Administrations des Postes et des Telecommunications.

Now 26 countries in Europe have accepted the CEPT recommendation for visitors licensing, although only 15 countries have been able to implement it so far. This means that operating from another country within the CEPT concept does not require a separate application. This works the same as between the US and Canada.

We have two classes within CEPT rules, Class 1 for all modes and all frequencies and Class 2 for VHF/UHF. Of course, the national rules for the country we operate from must be followed.

Unfortunately, the Swedish Telecommunications Administration has not been able to implement the CEPT license fully. Only Class 2 is allowed here regardless of which license you hold in your home country. Swedish hams visiting other CEPT countries are not limited by this restriction. However, there is still the possibility of applying for a regular visitor's license. A fee is charged for that one, though.

Sweden does not require a reciprocal agreement for issuing a visitor's license. Work is in progress for implementing the CEPT Class 1 also in Sweden, and we hope for a good outcome.

HAREC Harmonized Amateur Radio Examinations Certificate (HAREC) is a new recommendation from CEPT which hopefully will be implemented later this year. The recommendation is that each CEPT country should have two classes of amateur radio license for which the requirements are similar. For example, Sweden has a Morse code requirement of 80 letters a minute (16 WPM) while most other countries have only 60 for the same kind of license. Sweden will probably lower its requirement to 60 (12 WPM).

When HAREC is implemented, a person from a CEPT country who moves to another CEPT country does not go through a new amateur license examination. The harmonization means that CEPT countries will accept the other countries' license for the issuing of one in the new country. Many countries do already apply this in reality, but sometimes it's difficult to determine the comparative class of license. Regardless of HAREC, each country may have other classes of license in addition to these two harmonized ones, one for full privileges and one for VHF/UHF without Morse code requirement.

Top Band Widened in SM Swedish hams got more frequencies on the top band 1.8 MHz from February 1, 1990. The maximum power limit was also increased from 10 W input to 100 W PEP output. For the WARC bands the power limit was increased to 150 W PEP output. For other ham bands the maximum power limit is still 500 W input. A change will probably be made in the future and we do not know in which direction!

The frequency band on 1.8 MHz is now 1820 to 1850 kHz. SSB is now also allowed as well as participation in contests. This is also valid for the WARC bands, but on 10 MHz no contesting is allowed. 73

Number 41 on your Feedback card

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Your Bulletin Board

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I would like to receive information about satellite TV systems and design manuals, etc. *Arturo Marin, PO Box 948, Woodland CA 95695.*

I need any and all information on Dentron MLX-Mini 20 meter QRP, also EDGECOM System 3000 or FMS25. I will reimburse anyone for photocopies of manuals and schematics of these transceivers, service info, sales brochures and reference to anyone who might help repair these radios. *Mike Herman KC9NF, 1549 N. Cicero Ave., Chicago IL 60651.*

Needed: A diagram and manual for the Hammalund HQ 170 receiver. I will gladly pay for this info. Thanks. *R. Vic D'Agostino, 2113 Sunnythorn Rd., Middle River MD 21220.*

I am looking for info about the Allied Communications receiver, Model #A-2516. I would like a schematic, service info and info on how to use the VFO with a transmitter. *Jon Danford KACEM/0SOV, 2115 Joplin Ave., Joplin MO 64804. (417) 781–5243.*

I need a schematic and other associated documentation for an old Western Electric touch-tone pad, Model #1035C3A3. Thank you. *Joseph P. Jatis W9CYT, 1515 Somerset Lane, Schaumburg IL 60193.*

I need the following for my high school radio club: T-BUG monitor system for TRS-80 Model I assembly language, on tape or disk. Schematic diagram for R-19 military surplus receiver. Thanks. *John White, 560 N. Indiana St., Porterville CA 93257-2037.*

I would like to get in touch with hams operating 2 meter packet using a Texas Instrument TI/99-4A computer with a Kantronics TNC, Model KPC-2. *Bill Soble W3QXT, 9357 Hoff St., Philadelphia PA 19115.*

Blind, handicapped, house-bound ham with arthritis for 20 years wants to hear from people and seeks a portable shortwave receiver. If you have one you don't use, he would put it to good use with much appreciation. *Richard Lewis, 5909 W. 6th St., Los Angeles CA 90036. (213) 938–5347.*

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So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Start with a Dead VCR

This month's project is a bit on the strange side. From the mail bag, I've received a lot of letters complaining about the lack of parts for building. Also, I've been asked for a small power supply for operating QRP equipment that's easy to build.

In the past, we've had several power supply projects which required some new parts. This month we'll build a one-amp regulated supply without spending any money.

Now how is this going to be possible, you ask? The supply shown in the photographs was constructed from the parts lying on the top of my workbench. Yes, I do have a large messy workbench, but with just a little bit of scrounging, you should be able to reproduce this project. Without spending your beer money.

The heart of this project is a VCR; a dead VCR. I picked up a used Sony Betamax at a hamfest. The owner said it only needed a fuse. Well, for ten bucks, what the heck. I took the bait and was the proud owner of a dead VCR.

The previous owner was correct in one thing. The VCR did in fact need a fuse. What he forgot to tell me was that it also needed a capstan drive motor, head guide pins, and a few dozen small parts.

Playing with the thing, I learned quite a bit about the drive and tape transport system of a VCR. I got my ten bucks out of it and had a grand time, too. The VCR ended up in the junk box.

The Art of VCR Dissection

When I was looking around the shack for parts for this month's project, the dead VCR rang a bell. I have no idea how much power is need to operate all the drive motors, electronics, and whatnots inside one of those things, but the power transformer LOOKED right for my needs. So, armed with screw drivers and wire cutters, I gutted the thing. God! What great fun!

The most prized treasure was the power transformer. It was well shielded, and there were several secondary windings. Guessing from the size of the wires coming from the secondary, the transformer looked like it could produce at least one amp. Perhaps even more. One amp will supply us with quite a bit of power to operate QRP equipment.

In my zest with the wire cutters, I lost the pinouts for the transformer. Armed with a suicide cord and a VOM, I traced the wad of wires. As it turned out, the transformer had two windings at 14.8 volts each, one at 18 volts, and still one more at 40 volts. I cut the 40 volt wires short and taped them off. I didn't need those running loose inside my supply.

The 18 volt secondary was a bit of a problem. The wire size was too small to carry the required one amp. The short circuit current turned out to be only 250 mA.

The 14.8 volt secondary had heavy wires coming from the transformer, but the voltage is a bit low for a regulator. Most regulators require at least five volts ABOVE the regulated voltage, hence the usual 18 volt secondary.

Making New Connections

I connected both 14.8 volt secondaries in series. The result, as it should have been, was about 30 volts. This was way too high for my needs, aside from the fact that the capacitors I had planned to use only had a voltage rating of 35 VDC. The regulator would have to drop the surplus voltage in the form of heat, which was unacceptable.

What I did was wire both 14.8 volt secondaries in parallel. This increased the current to the bridge rectifier/filter capacitors, and the extra current helped keep the voltage stable under load.

The filter capacitors came from the VCR power supply; I un-soldered the caps from the power supply PC board. Using all the capacitors from the VCR, I came up with about 10,000 µF. I mounted the capacitors on a piece of perfboard, wiring them in parallel. The working voltage of the capacitors are all the same; 35 VDC. Some plastic standoffs support the filter board above the chassis.

The VCR used single diodes in a bridge configuration. I did not want to use the diodes from the VCR, so I chose a full-wave bridge rectifier, a small 6 amp job in a 1.5-inch square block, from the junk box. I could have used the diodes from the VCR, but I just didn't want to mess with them.

The diode bridge is mounted to the rear of the chassis. Use some heat-sink compound to aid in cooling the device. To keep an eye on what's going on with the supply, I used two lamps. I placed one across the filter capacitors and the other across the output of the regulator. This way, when the power supply is one, both lamps should be glowing. If you short the output of the supply, the lamp on the regulator will go out. This will let you know something is wrong with the supply or the connections to your project.

The VCR did not have the needed lamps, but the junk box yielded some nice ones. There was only one problem with them. The lamps were designed for 6 volts, not 12. Adding a current limiting resistor kept the lamps from burning out. If you have the proper lamps to begin with, you won't need to add the resistor.

On the AC line part of the supply, I added some bypassing. This helped keep RF out of the supply. The values came from the VCR. Nothing is critical, so use what you have, but watch the working voltage of the parts. Don't use anything less than 600 VDC for the capacitors. Also, don't forget the fuse and the three-wire power cord. Again, the VCR supplied the needed parts.

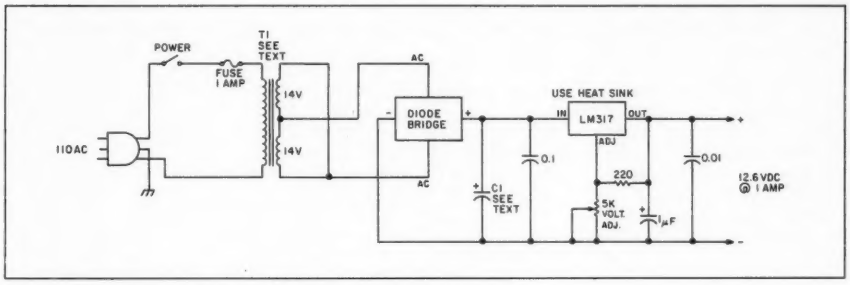

Figure 1. Schematic for the VCR junk box, one-amp regulated supply.

Stage by Stage

The heart of the supply, a simple three-wire LM317 regulator, sells for about $2 each at Radio Shack. In my supply, I use the 317, but in a TO-3 case. It's much easier to work with. The LM317 must be heat-sinked and insulated from the chassis.

Wire the supply up in stages. Do the AC line side first. Check for proper secondary AC voltage to the diode bridge. Check for output on the filter capacitors. This should be about 16 volts, depending on the secondary voltage of the transformer.

Wire up the regulator as per Figure 1. Adjust the trim pot for 12.6 volts output. That's all there is to it! The LM317 will supply one amp of current. That's about 12 watts of power. Five-way binding posts allow for easy hook-up. Not too bad considering what we have in the complete supply.

Button everything up and make sure you have taped off any unused secondary wires from the transformer.

Of course, you don't need a dead VCR to build this supply. I came across a dead computer monitor for the transformer. 73

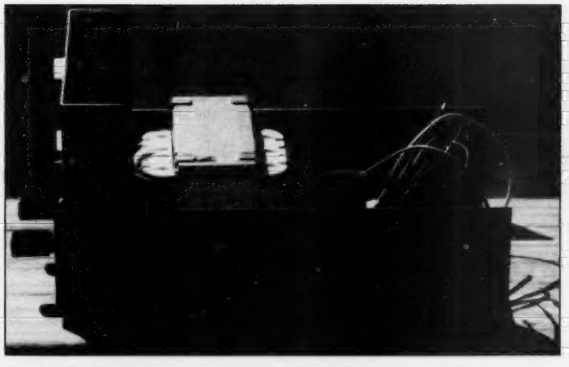

Photo A. The VCR power transformer, ready for wiring.

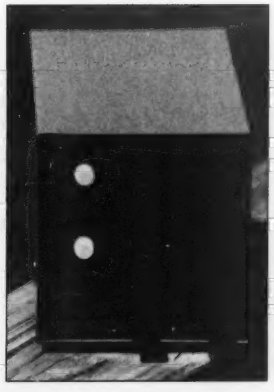

Photo B. The completed VCR supply project. Cost? Zip!

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HOMING IN

Radio Direction Finding

Joe Moell, P.E. KØOV
PO Box 2508
Fullerton CA 92633

Sniff with a Bug Buster

Some T-hunters are downright disappointed when they find the hidden transmitter sitting in someone's car out in plain sight at the end of a paved road. To them, a transmitter hunt is not complete without a chance to go "sniffing" on foot at the end. I must admit that I always welcome a challenging sniff, too. I certainly can use the exercise!

Still, there are many hunters who grumble when forced to walk to a concealed fox, because they don't have sniffing gear. "Body fades" with a handie-talkie are OK for beginners, but frequent hunters ought to carry a good field strength meter (FSM).

Traditional FSMs use a crystal diode detector (such as the 1N34A) and a high gain DC amplifier. Sensitivity down to 100 microvolts is possible with good diodes and FET input op amps. But the DC amplifier's offset drift means that a front panel zero control is required. Zeroing is tricky at high gain settings.

A Sniffer for the '90s

New RF technology is making the traditional detector/amplifier FSM obsolete. One-chip RF amplifiers that are nearly flat from HF to microwaves are now common and inexpensive. Putting the gain at RF instead of DC eliminates the zeroing problem.

Several companies make monolithic wideband RF amplifiers. You can experiment with the Avantek MSA0235-22, available from BCD Electro (PO Box 450207, Garland TX 75045-0207; 214-343-1770) or the NEC UPC1651G sold by All Electronics (PO Box 567, Van Nuys CA 91408; 818-904-0524).

For most simple projects, I prefer to dispense with an etched board and just wire the parts together on perf board. With RF circuits like this, however, a PC board and stripline techniques are musts for stability and wide bandwidth.

Optoelectronics Company (5821 NE 14th Avenue, Fort Lauderdale, FL 33334; 305-771-2050) has the answer. This company, well known for its handheld frequency counters, makes a sensitive FSM, model CCB. It features two Mini-Circuits MAR-6 wideband amplifiers and a logarithmic LED bar graph indicator.

The primary market for the CCB is people who think that there are tiny RF bugs all over their homes and offices, ready to pick up and transmit their most intimate conversations to earphone-wearing agents in trench coats sitting in dark vans. With the CCB and a whip antenna, these folks can while away the hours wandering around and checking their cupboards for the little critters.

I'm in no position to say how well the CCB works at detecting flea-power hidden mikes and wiretaps, but I found it to be great at T-hunt sniffing. At $99.95 wired and tested (add $3.50 to all prices for shipping), it's a bit pricey. Fortunately, there is a lower cost option. For $59.95, you can order the PC board and all parts, except cabinet, plus complete assembly instructions and a 7″ x 9″ blow-up photo of the completed board to guide you.

Make It Better

For another $20, you can get the company's nice cabinet for the CCB, but you can do better for less. I put the board on standoffs in a 4-½″ x 3-½″ x 1″ aluminum chassis (about $7 locally). I made a front panel of surplus copper-clad PC board material (see Photo A).

A single 9 volt battery provides power, but my chassis has room for two batteries. After several bad experiences, I learned to have a spare battery available at the flick of a switch in every piece of RDF gear. I also added a test jack next to the dual battery power switch, so I can quickly check the condition of both batteries with the multimeter in my tool kit.

The monolithic amplifiers are tiny dots of plastic, about 1/16″ in diameter, with four leads: input, output, and two grounds. Each of the two RF stages consists of just an amplifier, an RF choke to supply power, and coupling capacitors (see Figure 1).

The RF stages drive a Schottky detector diode, with DC bias for maximum sensitivity and good linearity. Detector output goes to a bar graph LED driver. A separate biased diode connects to the reference input of the driver IC. The two diodes track each other with temperature variations, so zeroing is a set-and-forget procedure.

With all LEDs lit, the sniffer draws 190 mA. That will drain the battery in a hurry. You will want to use the switch-selectable DOT mode instead of the BAR mode for most situations. Save the BAR mode for those pitch black no-moon night hunts when you can't see the position of the single dot. Current drain in the dot mode is 65 mA.

Experienced builders will have no serious problems building up the Optoelectronics CCB board. But you will need sharp eyes and steady hands. You'll also need a pencil iron with a tiny tip. A large illuminated magnifier would be a big help, particularly if you have "over-forty" eyes.

The etch and eyelets are tiny. Soldering on the three surface mount chip capacitors is tricky. You also have to carefully scrape away the green mask in many places to make room to solder down the RF components.

It Finds the Fox

I adjusted the internal zero control (R11) so that the leftmost LED is on with no signal input. Minimum RF sensitivity of the CCB sniffer is 600 to 800 microvolts, depending on the setting of R11. That's the level at which the second LED just comes on.

The CCB gives about the best sensitivity one can ask for in a wideband sniffer like this. Sure, you could add another RF stage or two, but it would do little good. Just about anywhere you go, there will be enough ambient RF in this wide spectrum to give you a few hundred microvolts from almost any antenna. This ambient RF masks weaker signals.

Although you could add internal tuned circuits and more gain, you won't need it for sniffing out most ham radio foxes. With a quarter-wave whip antenna, the CCB detects a 2 meter 1 watt handheld well beyond 500 feet away. Connected to a low-output military surplus loop, it got bearings on a 6 meter mobile station from 200 feet.

Your FSM may also come in handy while mobile, if the hider uses very high power and "swamps out" your receiver/attenuator combination. One night I used it with a full-size quad and attenuator to get bearings on a high power 2 meter fox from over a mile away in open country. The signal was so powerful that RF went around my attenuator and through the mobile transceiver's case. But the sniffer worked fine.

Advertised frequency range of the CCB is 10 to 2500 MHz. Response is fairly flat to 700 MHz, then it begins to fall off. Full sensitivity on 10 ham bands without tuning—that's pretty good!

Fixing the Glitches

There are a couple of minor design problems with the CCB circuit. Zero control R11 is a single-turn 5k pot. It's far too touchy and too high in value. The required resistance is about 250 ohms, so I removed the supplied part and substituted a 500 ohm multi-turn trimming pot. That made set-up much easier.

A 6.5 volt regulator supplies Vcc to the amplifier and display, intended to give constant sensitivity as the battery ages. But the regulator is an LM317, which has high offset voltage. It falls out of regulation when the battery drops below 7.9 volts. I want the unit to work with battery voltages down to 6.5 volts. There are low dropout regulators, such as the LM2941, that should allow it.

The bar graph readout is great at night, but it washes out in the bright sun. I added a hood to the front panel, made from ¾″ wide strips of PC board material soldered together. With this shade, the LEDs are much easier to see in daylight.

How Close Am I?

Ordinary field strength meters give readings that are linear with input RF voltage. The LM3915 bar graph IC is different; it gives a logarithmic response. Each successive LED in the display represents 3 dB more signal than the one to its left. All other factors being equal, this means that as you walk toward the fox, the indication will increase two LEDs each time you halve the distance.

For example, let's say you get to the end of the road and the beam on the car indicates the fox is somewhere in the cactus patch ahead. You get out, pull up the whip, and the display shows LED #3. You count your steps as you gingerly walk in the direction that the beam points. When LED #5 comes on, you have gone 200 feet. That means the hidden T should be about another 200 feet away.

LED #7 should come on when you're 100 feet away, and LED #9 at about 50 feet. Of course, this method won't work if there are intervening obstructions or if the hider is varying the transmitter power. The distances given are relative, and applicable only to this example.

The logarithmic LED display eliminates the need for a sensitivity control, but occasionally you will encounter a very high power hidden T that "pins" the display before you find it. I added S3 and R12 for that condition (See Figure 1).

Closing slide switch S3 reduces the gain of the first RF stage by reducing its supply voltage. It changes the "pinning" sensitivity from 30 millivolts to 300 millivolts. Keep the R12 leads short.

OK, hunters, now you have no excuse when you are unable to walk up to the fox at the end of a hunt. See you at the hidden T! 73

Photo A. KØOV version of the Optoelectronics sniffer, with dual battery power switch and test point on top. The home-brew hood makes the LED display visible in sunlight.

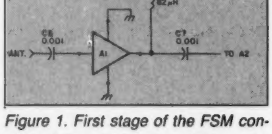

Figure 1. First stage of the FSM consists of the wideband amplifier and a few additional parts. R12 and S3 are added to provide switchable gain reduction.

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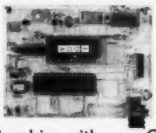

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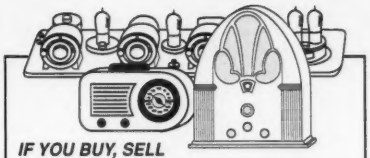

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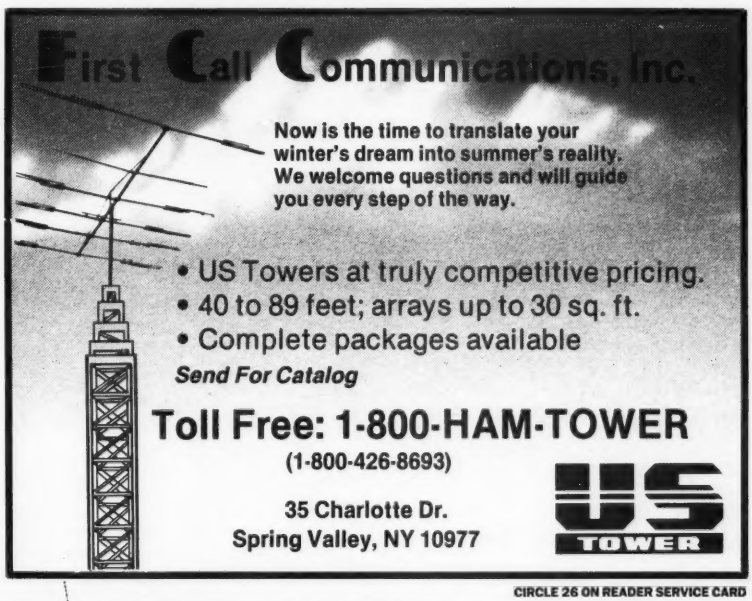
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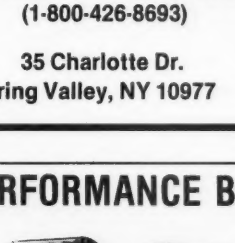

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Never Say Die

Continued from page 4

getting the League to provide the leadership amateur radio desperately needs right now. The cure is simple . . . elect new directors who can bring business expertise to running this $10 million business instead of trying to siphon off everything they can for themselves.

Hey, even if you are so brainwashed that you truly believe that I'm totally wrong . . . that I'm lying to "sell magazines" . . . what have you possibly got to lose in helping to elect some new directors? And why would you be against their being experienced businessmen instead of old ARRL organization hams who have gradually worked their way up the ladder to the most prestigious level of all?

No sharp businessman (entrepreneur) would waste his time with such a trivial pursuit of power and recognition as the League organization offers.

Do we need to throw all the rascals out? No, oddly enough there are a few intelligent directors who would like to help the League start providing leadership for our hobby. Unfortunately, they are greatly outnumbered.

Pressure Points

How can you, as one single amateur, make your opinion felt at HQ? You can do much more than you think. For instance, if you are a member you can make sure you vote in your next election. You can look at the business credentials of the office seekers and avoid anyone with a long list of League appointments.

You can make it your business to get to know the hams running for director and vice director and do what you can over the air and at local club meetings to bring about a change.

If you're not a member you have an even stronger say. The League lives or dies on your decision to join. If you pay your money, that's your vote for the status quo. Why should they change as long as you're sending them money every year anyway?

Your real power lies via the mail. In this you have an enormous lever to get the League directors to shape up. No, not in writing to them and complaining. Remember, most of 'em think you are an idiot. But you wouldn't believe what an effect you can have if you start writing to the *QST* advertisers and telling 'em that their supporting the League is going to affect your equipment buying decisions.

You see, power goes where the money goes. Money is power, right? That's not a new concept. Well, if you spend the dollar and look at the ARRL's financial statements, even as laundered as they are, you can see that a one-page advertiser in *QST* brings in far more money than a thousand members. So, while they can afford to ignore your individual complaints, you better believe they're not going to ignore any unhappiness coming from their horn of plenty.

You've got a powerful lever there, if you'll use it. Advertisers, who are not used to hearing this sort of thing, will start getting nervous when they get their first letter. By a half dozen they're going to be on the phone to Newington. If they get a thousand such letters, even the most dim-witted directors will be asking, "How far do you want me to jump?"

Yes, I know you're dreadfully busy. You certainly don't want to have to miss Twin Peaks or The Simpsons for something as trivial as this. And besides, your high school spiral notebook is almost out of pages by now, so you haven't any stationery. Further, suppose the advertiser lets the League know of your perfidy and they send their goon squad to break your legs? Maybe you'd better send your letter anonymously, just to be safe. Sure, that sounds silly, but I've met amateurs who really believe it.

The League sure has managed to instill fear in its members. I'll bet that 60% of the mail I get critical of the League asks please not to mention their name or call if I print the letter. I can't imagine what they think will happen to them. Has the ARRL got a KGB branch with enforcers who make people disappear? Have we got death squads in our hobby? You'd certainly think so to see the letters I get . . . and lots of 'em.

The Changes

I outlined the two basic changes the League needs to make to get our amateur radio hobby back into the black. We need to get our bands cleaned up. We need to put good strong peer pressure on the crazies and idiots who are using bad language, jamming, and otherwise making it less fun to be on the air for the rest of us.

Then we must organize a public relations campaign to acquaint the general public with our hobby. We must make sure that kids are aware of amateur radio and at least consider it as an alternative to all those heavily advertised computer games. We have lots to offer kids, if we can get the leadership we need to make it happen.

How much would it cost to set up and fund the two teams I suggested? For an organization the size of the League, with millions stashed away for a rainy day, any pleading that they don't have the money is absurd. It's already raining! Just take one look at their balance sheet that you got when you bought their annual report for a dollar and you'll see that this is a matter of management, not money.

I'm not talking about hiring a big bucks Madison Avenue advertising agency and budgeting a million dollars of ads . . . about what it takes for one minute of TV during the superbowl game. I'm talking PR, where the cost is miniscule and the results king-sized.

I'm not talking about $100,000 videos extolling amateur radio . . . extravaganzas which are mainly self-congratulatory and do virtually nothing to get across to the general public how much fun we're having and how little our hobby actually can cost.

 CIRCLE 145 ON READER SERVICE CARD

If you want to sell a product you point out the benefits to the customer, not the technical specs. We should be showing kids having a ball hunting hidden transmitters on foot. We should show young hams swarming over hamfest flea markets, buying cheap used equipment. We should show 10m Novice DX QSL collections.

With a little editing the League could put together one whale of a Field Day video, made up from home videos sent in by a couple hundred affiliated clubs.

The money is there. The resources are there to do what needs to be done. The only thing lacking is for the leadership to make it happen.

You have the choice. You can, with a couple dozen letters, change the history of amateur radio. Or you can let it continue to gradually slide into oblivion. And there's just a chance that if you do write and the League is pushed into getting our hobby growing again, that the kids we bring in will be the American engineers, technicians and scientists our country so desperately is going to need in the future.

Making Some Money

Letters are still coming in from readers complaining about being short of money. When one considers how much of it is out there and how easy it is to get, I wonder why there isn't more interest in improving the odds.

The Financial News Network (FNN) Entrepreneurial Van stopped by to interview me a few days ago. One of the questions they asked, naturally, was how I'm able to spot so many potential businesses. How was I able to figure out ahead of time that cellular radio would be big? That microcomputers would be enormous? That compact discs would grow as they have?

I'm giving a talk in a few days to a Mensa (high IQ) group on the subject of being successful. In case you are laboring under the mistaken idea that it takes brains to be a success, I might point out that there seems to be little relationship between brains and success. Ray Croc, the McDonald's chap, wrote that in his book on how to be successful. Even after meeting and talking with several thousand Mensans I have no reason to challenge the concept. They're a great bunch of underachievers.

As a ham, unless you cheated to get your ticket, presumably you have both a knowledge of electronic fundamentals and an interest in learning more. This gives you an edge. And that's what you need to get more than your share. Gelt without guilt, right?

If you think we're living in a technological age now, wait'll you see what's coming. Technology is going to keep right on growing, whether you are able to cope with it or not. And the better you're able to cope, the more potential you have to make money.

Technology tends to bewilder older people. Kids, who have no fear of computers, jump right in. Of course they make up for their ability to use computers by a growing inability to understand them. Kids, abetted by their parents, who are busy watching ballgames on TV, opt for the easy. They are avoiding math and science courses. Too much trouble.

There I go grumbling about how parents are allowing their children to be dummies. Encouraging them, really. That isn't going to help you make money, is it? Well, not unless you take note of the problem and keep it in mind so that when something turns up which might help solve the problem, you'll look into it.

The easiest way to make money is to find a product or service that is needed and supply it. Find a niche and fill it. There's nothing new about that advice, but how seriously have you integrated that concept into your own thinking? Once you start applying the idea to real life, you'll start seeing all sorts of wide open niches.

Okay, presuming that you have some electronics skills, they will open more and more opportunities to you as the whole world goes high tech. Right now there's a tremendous need for people to fix electronic equipment. If you start specializing in computer repair in your spare time, you'll quickly find your time filled up. One thing we know for sure about electronics, everything breaks. If you can fix 'em, you're in business.

VCRs, which are in almost every home, break. They break a lot. Has it ever crossed your mind to find someone who fixes VCRs and see if he needs some help? That comes down to the most basic of common sense... why spend your own money to learn when there are people who will be delighted to pay you? Learn on other people's money. Once you're good at VCR repairs you can open your own shop.

When you have more business than you can handle, hire on someone and train them. If they're entrepreneurially inclined you'll be training a competitor. If not, maybe you can open a second shop a few miles away.

Audio equipment breaks. Radios break. Ham gear breaks. Getting things fixed today is a major hassle, as you well know. Heck, many families throw out old VCRs instead of getting 'em fixed. Cheaper. Maybe you can get 'em to throw their broken VCRs your way...then you can fix 'em and sell secondhand VCRs with your guarantee.

Years ago I editorialized about getting into the home security business. I keep hearing from readers who took me up on it and have done well. Some have built multimillion dollar businesses. There was a ham here in New Hampshire who said my editorial got him going, but alas he didn't pay attention to my advice on smoking, so he dropped dead in his 40s.

The latest Heathkit catalog got me all excited. Their big new push is in gadgets to remotely control your house lights and appliances. What a fantastic opportunity, since you presumably understand how these things work, to sell, install and service them.

I'd sit down at a Macintosh desktop publishing system and put together a

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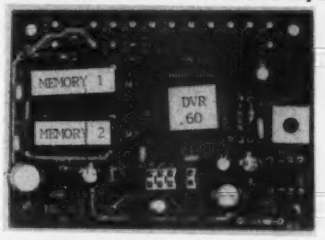

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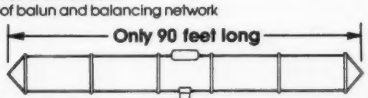

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CIRCLE 53 ON READER SERVICE CARD

catalog to spread around the neighborhood, looking for potential customers for these systems.

Heath also sells some nice home security products. . . plus there are several mail order security product firms.

People love gadgets, but their ignorance of electronics makes them afraid to even try to use them. I'll bet you can find an endless supply of people who would love to have remote home control units, if only someone else would install a system and teach them how to use it.

While you're there you might also show them how to program their VCR. I forget the percentage of homes where no one knows how to do it, but it's depressing. They just use it to watch rented movies or to make instant recordings. When they get a new VCR you can come in and show 'em how to use it. They're all different.

The opportunities to make money are everywhere you turn, once you tune your mind to that wavelength. The primary obstacle to having all the money you want is your own inertia. You have, somehow, to develop your own drive, to be different. Inertia. . . habit patterns we're too lazy to try and break. It's the same inertia you face in making other life changes, such as investing in travel, getting your weight down to where you know it should be, kicking various drug habits such as beer and cigarettes. . . things which will help you live longer and enjoy your later years more.

There are two hard parts. First is making the decision to change. Second is to stick to it when temptation comes. . . which it will. That's when you face your most difficult test of character. Keep your goal in mind, whether it be to make money, lose weight, or kick a drug habit.

Yes, I know all about your not having time. Sure. Tell me about time. I'm writing this on my laptop computer on a flight from New Orleans to Atlanta. Sherry and I popped down to Mobile and New Orleans for the weekend. I got together with my old WWII submarine shipmates for a reunion aboard our old boat, the *Drum SS-228*, which is on display in Battleship Park in Mobile. Murray Flanders K4RQQ has a ham rig set up on board. . . look for him Saturdays at 1600Z on 14,243.XXX.

While there I gave a talk to the Mobile ham club about the no-code rulemaking proposal. They fielded over 80 members for the meeting!

I also had an opportunity to meet the new skipper of the battleship *Alabama*, Fred Lovewood WA4JVA. I immediately came up with an idea for making the *Drum* a lot more fun for visitors. How about setting up speakers in each compartment which explain what went on there during a war patrol? Then, maybe every 20 minutes, break in on the explanations with the battle alarm, dim the lights and announce that the boat is being attacked and is going to submerge. The diving alarm would sound, then the sound of air whooshing out of the tanks, "rig all compartments for depth charge and run silent," then there would be the sound of screws passing overhead, a series of realistic depth charge explosions and more lights flickering. Finally, a voice says, "We've managed to evade them, Captain." "Secure from depth charge, secure from battle stations, surface." The surface alarm sounds and the lights go back to normal. The idea is to put some excitement into the visit to the *Drum* and make it more than a look at a bunch of gauges and valves. Take a cue from Disneyland and make it an exciting visit. The whole thing shouldn't cost much to set up.

After the memorial services aboard the *Drum* we drove to New Orleans to arrange for pictures to be taken for the second Scott Kirby album of Scott Joplin music. Scott recorded it in our Hancock studio, but we needed a picture showing him at his street piano with a Mississippi river boat in the background.

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Scott took a day off from playing Joplin on Royale Street in the French Quarter. We found just the right spot for a photo for his new album. . . a place where he would be able to roll his piano.

When you get to be my age (68), are you going to be making money hand over fist and having the time of your life, or are you going to turn into a veggie and stop all further contributions to the world. . . other than helping maintain a QRM layer on the air?

In addition to getting your own business going and making money. . . lots of money. . . you're needed to help get PR for amateur radio, to help get radio clubs started in local schools, to teach ham classes and so on. There's more than enough for you to do, no matter how old or young you are.

Good-Bye *Ham Radio* Magazine

It did not come as any big surprise when *HR* announced its demise. They'd been up for grabs for several years and we'd been dickering with them recently to fulfill their subscription obligations. Apparently *CQ* was in more desperate need of a circulation boost than *73* and outbid us.

With amateur radio winding down, the ham industry has less and less money for advertising, so there just wasn't enough to support four magazines. I doubt there's enough to keep three going, but we'll see, won't we?

HR blew away mainly because the publisher didn't have anything else to tide him over the tough times. My *CD Review* is doing fine thank you, and is quite capable of keeping us growing no matter what happens to the ham industry. *CDR* was one of the fastest growing magazines in the country last year and will be again this year. It's growing right along with the music industry, buoyed up by the exploding CD market.

I'm starting several new industry trade publications to help the music industry grow even faster. If you're looking for a fun industry to get into, you might consider the record business. It's really just started in its growth. For instance, Europe is way ahead of us already. 40% of the Europeans have CD players now vs. 20% in the U.S. You only have to look at the European record stores to see where things are headed here.

Getting back to the *HR* debacle. Publishers who don't diversify can get in trouble when their industry is depressed. *CQ* is facing the same desperate dilemma. They've got a couple of other small new publications, but they're not in growing industries either. And their ham niche is awfully narrow: contesting.

Contesting pretty much rules out any great enthusiasm from Novice, Tech or General Class licensees. This is why I suspect they're going to be very disappointed in the reaction of the *HR* subscribers to the change. If the sentiment expressed at the *73* booth at Dayton is at all indicative, they'll get very few renewals. We had the biggest year ever for subscribers at our booth, with a high percentage of them very vocal about the *HR* disaster.

I've seen this happen before. A good friend of mine, David Ahl, published *Creative Computing*. He got sucked into buying a subscription list from a dying computer publication and the added costs put him out of business. He had to sell for peanuts to Ziff-Davis, where his magazine was eventually folded.

Buying the subscription list of a failed magazine is a serious gamble. The publisher is betting that the readers will renew their subscriptions for several years, thus eventually recouping his investment. Even if he only pays a dollar for the list, which is the usual price, he's still got the enormous expense of sending his magazine every month.

Of course, if he increases his advertising rates to reflect the larger circulation, he can benefit. Unfortunately, it takes months before the new ad rates take effect, so that's a long term benefit. . . and only if the readers do actually renew. I haven't seen any increased *CQ* ad rates in effect yet.

What about all those nice construction articles which made *HR* so popular with the more technically inclined hams? We had a parade of *HR* authors coming by the *73* booth at Dayton to discuss writing for us. Where else could they go? We've gotten promises of great material, so I think we'll be holding up that end of things just fine.

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It took the military twenty years before they started using her technology. Today it's a staple of military communications.

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If you'd read *Forbes*, like you should, you'd know about all this. 73

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No-Code or a Contest of Will

No-code will either be the FCC's way or it will be the FCC's way. That's the feeling I got as I sat in on a presentation by commission representatives to the Amateur Radio Industry Association's April 27th meeting in Dayton, and also at the review of an audiocassette of the FCC's forum at the Hamvention. The presentation was a sobering experience, one I want to share with you.

The facts of life appear to be these. The FCC has opened the no-code Pandora's Box only because the ARRL was willing to let it be opened. But this time that box will not be shut if the ARRL changes its mind. In other words, some form of no-code license will probably be a reality within a year or so, with its privileges to be determined from comments. What appears to have been determined already is that this new code-free Communicator ticket will be created, and it will replace the current Novice and Technician Class licenses as the singular entry level to the United States Amateur Radio Service.

For what they claim to be budgetary reasons, this is not a negotiable point with the commission. The only parameter we as hams can help set—with emphasis on the "help"—is the difficulty of entry. If my assumptions from all the foregoing are correct, then it stinks!

Hidden Motives?

A number of years ago, an FCC official who will remain nameless told me that ". . . the ARRL is under the mistaken belief that it is at war with the FCC, only we at the commission have not noticed the shells yet." Could it be that this is the government's way of finally saying that they have taken note of the artillery from Newington and that this is their return volley? I say this because the proposal as outlined in Docket 90-55 is so absurd as to make me wonder if there is a more sinister reason behind the latest no-code move.

There can be one, and only one, reason to abolish the code requirement for entry into amateur radio—growth. Massive growth at levels unprecedented in the history of the service. Clearly, then, the way to such expansion is through simplification of the examination and a lowering of the entry level standards. Is creating an examination with more than twice the technical difficulty level of the current license going to achieve this goal? Only a blathering imbecile would believe that it would! I sincerely hope that you are not the latter.

To grow, amateur radio does need code-free entry. It needs what amounts to a simple-to-attain license with mainstream operating privileges. By dropping the code requirement from the current Novice, and deleting the 10 meter privileges for anyone entering the service after implementation, this is easily accomplished. Cost is minimal and nothing much changes. This is the obvious solution to a tough problem, and one that most hams would be willing to live with.

But there is one fly in the ointment. The FCC is living under a yet-to-be-proven belief that rampant cheating is taking place in Novice licensing, and that they must do something about it. I was amazed to learn that they are convinced, or at least they say they are convinced, that the level of those getting Novice tickets in ways that violate federal law is so high that they must look for a way to violate federal law to abolish the license! That's right, I say openly that the FCC is looking to circumvent Public Law 259!

A Bit of History

When US Senator Barry M. Goldwater K7UGA sponsored the legislation that led to the creation of laws permitting the FCC to use volunteers for both amateur testing and regulatory enforcement, he threw in a kicker. Senator Goldwater clearly understood that the survival of our nation into the next century would depend on our being able to have a top-notch base of scientists and engineers. He also realized that amateur radio has always been a major route by which youngsters reached for those careers. So, the legislation contained wording to the effect that the Novice license would always be given free of charge.

This means that it cannot easily be brought in under the VEC testing system unless VECs are willing to administer the test free of charge—something very unlikely, given the costs of operating a testing organization. So, the boys on "M Street" have come up with what they think is a way to solve their perceived problem of Novice cheating and at the same time save a few dollars for the government.

Since the Novice ticket really can't be brought under the VEC testing system, they propose to abolish and create a new license that *can* be tested by the VEC system. In the process, they figure that they will be giving much tougher technical examinations for entry than ever before, so why not kill off the next step on the ladder as well?

This writer might be able to buy the approach if not for a few small items. First, let's have proof that this massive Novice cheating is taking place! So far, I know of only two cases that the FCC has publicized—one on Long Island, New York, and the other near San Juan, Puerto Rico. Both of these occurred more than two years ago, and nothing has been publicized since. Probably there is some cheating, but I'm willing to bet that it's no worse than before PL-259. And I don't think you can blame it on that farce called "Novice Enhancement," because the latter was of little benefit to Novices. It brought in Technician Class operators by the hordes, but Novices? Who is kidding who? It should have been called "Technician Enhancement." The commission is going to have to show me—and I hope, show you—a lot of documented cases of cheating and abuse to where the viability of the Novice license class is at stake before I'll buy that poppycock!

Second, there is the complexity of the proposed written test element. It would amount to a combination of the current Novice Class element, Technician Class element, and an additional five questions that the ARRL is demanding so as to appease its doddering masses. I don't know about you, but to my way of thinking, forcing someone to memorize—and I say memorize because that's the way it's done—that much knowledge just to talk across town on 220 MHz is not going to seem very enticing to very many. In fact, it will probably have the opposite effect. I seriously doubt if the almost minuscule growth of today's Novice can be attained with tomorrow's Communicator. Those of you who feel that "no growth is good growth" or that "our bands are too crowded" should be happy. At least until 20 and 40 meters disappear from use.

If I had my choice of staying with the current entry structure or going to the Communicator in the way it has been presented in Docket 90-55, I would opt for the Novice—and I am very much pro no-code! I feel that a properly written set of regulations creating a no-code license would go a long way toward revitalizing amateur radio. But what Docket 90-55 offers is not the needed "No-Code for Growth" that a good recruitment campaign can be built on. It's nothing but a trade-off between artificial barriers for very obvious political reasons.

Even with the 5 wpm CW test, the current Novice ticket is a lot easier to get—and that's apparently what the FCC does not like to see. The Novice also offers far more in the way of privileges than this "fallacy" called the Communicator. And maybe, generating feelings like these is the real aim of Docket 90-55. That of creating an air of discontent in the amateur community, and throwing a barb at the American Radio Relay League—the government's long awaited (and expected) return volley north toward Newington, Connecticut.

In my view, the FCC has put the ARRL, and the rest of us, into a no-win situation. If my assumptions are correct, we are seeing the result of several decades of the adversarial and sometimes confrontational relationship between our national society and the government body that regulates us. It's a mini-war that neither side will admit, but it started some 20 years ago at a hearing before the commission on a then-proposed ban on CB linear amplifiers.

Reportedly, the FCC commissioners were very much disenchanted with the way in which the ARRL presented its opposition to the ban, and the relationship has been downhill ever since. So is the amplifier ban that keeps you from buying an all-band linear that you don't have to modify yourself for 10 meters. (Yet the illegal CB amps are still available at truck-stops nationwide. Some ban!)

Who is the Communicator For?

And now we have the Communicator. A putrid excuse for a code-free entry level amateur license. A proposal with so many new artificial barriers to getting new people interested in amateur radio that I cannot believe it to be anything other than the aforementioned retaliation from the FCC to the ARRL. The Communicator will not entice youngsters to amateur radio because it offers them nothing they cannot get for $49 at K-Mart in the form of a CB set. It will make it more difficult for the elderly to study the material, retain it and join in, with the number of questions more than doubled.

As for the young adult busy starting a family, just forget it. The Communicator offers little. And for those just passing into middle age and with the greatest level of disposable income? People who have traditionally been the backbone of amateur radio? He and she are already hard targets to recruit. In this area, the Communicator, as proposed, will be a "death knell." How many of these people have left of their own accord after getting in the so-called "hard" Novice way?

So, what really scares me is the fear that many of the "doom and gloom" predictions of the publisher of this magazine will come to pass well before we depart this mortal world. More important, what makes me angry is that you and I really are a part of a "contest of will" between the FCC and the ARRL. Pawns in a chess game. I, for one, don't like being used! de WA6ITF 73

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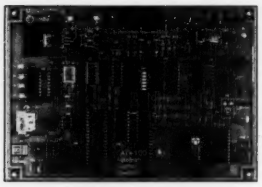

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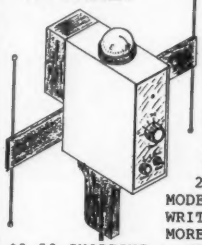

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Fascinating reading—new book covers all clandestine broadcasting, country by country—tells frequencies, other unpublished information—spy—insurgents—freedom fighters—rebel—anarchist radio—secret radio—covers all. Current publication. 84 pages. **$8.50**

05A95 • **Easy-up Antennas for Radio Listeners and Hams** *by Edward M. Noll*
Like to learn how to construct low-cost, easy-to-erect antennas? *Easy-up Antennas* will help you. **$16.50**

01B65 • **The Beginner's Handbook of Amateur Radio—2nd Editon**
by Clay Laster
Combines theory and practice in an easy-to-understand format, and provides information for choosing and installing radio receivers and transmitters, antennas, transmission lines, and test equipment. 400 pages, 291 illustrations. **$18.00**

01D40 • **DX Power: Effective Techniques for Radio Amateurs**
by Eugene B. Tilton K5RSG
256 pages, 10 illustrations. **$9.50**

Lanze Code Programs—(Available on 5¼" disk.)
Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, multiple choice answers, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

	IBM Part #	Commodore Part #	Price
Novice	IBM01	COM01	$14.95
Tech	IBM02	COM02	$14.95
General	IBM03	COM03	$14.95
Advance	IBM04	COM04	$19.95
Extra (New Pool)	IBM05	COM05	$19.95

IBM97 • **Amateur Radio Part 97 Rules** (includes updated revised Commission's Rules September 30, 1989) 5¼" disk IBM compatible only. **$9.95**

10M012 • **Map Library** *by Radio Amateur Callbook Inc.*
Includes: 1 Prefix Map of the World 4-color 40" x 28"
1 Map of North America 4-color 30" x 35"
1 Great Circle Chart of the World 4-color 30" x 35"
1 World Atlas 4-color 20 pages
$12.00

16S42 • **Shortwave Propagation Handbook**
by George Jacobs W3ASK and Ted Cohen N4XX
New revised edition. Contains up-to-the minute information and charts, and guides you through producing your own propagation data. 154 pages, paperback. **$9.95**

01P044 • **44 Power Supplies for Your Electronic Project**
by Robert J. Traister and Jonathan L. Mayo
Written at the basic level, perfect for the beginner. The reader is given enough electronic theory to understand the concepts explained throughout the book. **$15.95**

10W020 • **N6RJ Original 2nd Op** *by Jim Rafferty N6RJ*
A new edition in an easy-to-use "wheel" format. Simply dial the prefix and instantly have available Beam headings, Continent identifications, Zone idenfication, Postal rates, and more. **$8.95**

16PB6 • **Packet User's Notebook**
by Buck Rogers K4ABT
Over 90 diagrams show tried and true connections for popular TNCs, transceivers, and computers. A genuine nuts-and bolts how-to-do manual. Brand new! **$9.95**

09P33 • **The Pirate Radio Directory 1990 Edition**
by George Zeller
Contains data on some 100 pirate stations which were active during 1989. Sections on how to tune in pirate broadcasts and how to get QSLs from pirate stations. **$7.95**

09D22 • **The World Ham Net Directory** *by Mike Witkowski*
New—second edition now over 600 net listings. This book introduces the special interest ham radio networks and shows you when and where you can tune them in. **$9.50**

01D29 • **The Illustrated Dictionary of Electronics (4th Ed. 1988)**
by Rufus P. Turner and Stan Gibilisco
Over 450 detailed drawings and diagrams. Over 27,000 terms are addressed in 650 pages. Provides clear, brief, and easy-to-understand definitions. An excellent dictionary for the hobbyist or professional. **$24.95**

15A002 • **Scanner and Shortwave Answer Book**
by Bob Grove
Whether you have difficulty calculating world time zones or are trying to figure out kilohertz, megahertz, and meter band, this book will provide the answers. **$13.95**

10F090 • **1990 International Callbook**
Lists 500,000 licensed radio amateurs in the countries outside North America. Covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$30.00**

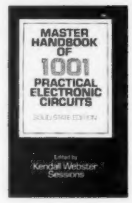
07A66 • **Aeronautical Communications Handbook**
by Robert E. Evans
An exhaustive and scholarly treatment of shortwave aeronautical listening. This book is well organized and up to date. 266 pp. **$19.95**

02C30 • **The Commodore Ham's Companion**
by Jim Grubbs K9EI
160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! **$9.50**

03S11 • **Shortwave Receivers Past and Present**
Edited by Fred J. Osterman
Concise guide to 200+ shortwave receivers manufactured in the last 20 years. Gives key information on each model including coverage, display, circuit type, performance, new value, used value, etc. Photos on most models. The Blue Book of shortwave radio value. 1987, 104 pages, 8½ x 11. **$6.95**

01A87 • **The Shortwave Listener's Antenna Handbook** *by Robert J. Traister*
If readers are looking for ways to beef up their shortwave reception capacity and increase listening enjoyment, this handbook can show how to accomplish it easily and inexpensively. **$12.00**

07R25 • **The RTTY Listener**
by Fred Osterman
This specialized book compiles issues 1 through 20 of the RTTY Listener Newsletter. It contains up to date, hard-to-find information on advance RTTY and FAX monitoring techniques and frequencies. 156 pp. **$19.95**



01C80 • **Master Handbook of 1001 Circuits—Solid-State Edition**
by Kendall Webster Sessions
With this outstanding reference in hand, electronics hobbyists and professionals will never have to search for schematics again. Completely updated, the book is thoroughly indexed and all 1001 circuits are clearly illustrated. 420 pages. **$19.50 soft cover**

05H24 • **Radio Handbook, 23rd Edition**
William I. Orr W6SAI
This book is filled with 840 pages of everything you wanted to know about radio communication. You will get an indepth study of AC/DC fundamentals, SSB, antennas, amplifiers, power supplies, and more. **$29.50 hard cover only**

03R01 • **World Press Services Frequencies (RTTY)**
by Thomas Harrington W8OMV
A comprehensive manual covering Radioteletype news monitoring—contains all information—antenna, receivers, terminal units, plus three extensive frequency lists. Covers 65 World Press Services broadcasting in English. "The Original Press Book." 84 pages. **$8.50**

10D090 • **1990 North American Callbook**
Lists over 500,000 licensed radio amateurs in all countries of North America. Gives calls, names, and address information. **$28.00**

05C63 • **Commodore 64 Troubleshooting & Repair Guide**
by Robert C. Brenner
This book will guide you step by step through the complexities of making simple repairs to your Commodore 64. **$19.50**

05C16 • **C64/128 Programs for Amateur Radio & Electronics** *by Joseph Carr*
The electronics hobbyist, programmer, engineer, and technician will enjoy the task-oriented programs for amateur radio and electronics in this book. **$14.50**

11T88 • **Tune in on Telephone Calls** *by Tom Kneitel K2AES*
This book is formatted as a frequency list, with detailed descriptions of each service and its location in the RF spectrum. It provides all the basic information for the casual listener to get started with radio-telephone monitoring, and many details for the ardent enthusiast. **$12.95**

ARRL BOOKS

AR2200 • **Antenna Impedance Matching**
by Wilfred N. Caron
Advanced amateurs, antenna design engineers, technicians. Most comprehensive book written on using Smith Charts in solving impedance matching problems. **$15.00**

AR2472 • **Tune in the World with Ham Radio Kit (8th ed)**
Revised text covers the question pools on Novice exams given on November 1, 1989 and later. Code-teaching and code-practice cassettes included in the kit. **$19.00**

AR2464 • **Tune in the World**
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AR2197 • **Data Book**
Valuable aid to the RF design engineer, technician, radio amateur, and experimenter. Commonly used tables, charts, and those hard-to-remember formulas. **$12.00**

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Written from an RFI sleuth's perspective. His experience in solving interference problems. **$12.00**

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AR2065 • **ARRL Antenna Book**
Represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. **$18.00**

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AR0356 • **Morse Code: The Essential Language**
by L. Peter Carron Jr. W3DKV
Tells of the evolution from straight key to computers. Gives practical advice on learning the code and its modern-day uses. **$5.00**

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42 papers covering verticals, yagis, quads, multiband and broadband systems, antenna selection, and much more. **$12.00**

AR0488 • **W1FB's Antenna Notebook**
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Get the best performance out of unobtrusive wire antennas and verticals. Build tuner and SWR bridges. **$8.00**

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Presents construction projects for the QRP operator, from a simple 1 watt crystal-controlled transmitter to more complex transceiver designs. **$6.00**

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Beginning with *Tune in the World with Ham Radio* for the Novice and progressing through the critically acclaimed *ARRL License Manual* series for the Technician through Extra Class; accurate text explanations of the material covered along with FCC question pools and answer keys.
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Material from a series of articles published by *Ham Radio*, polished and expanded by Dr. Lawson. **$15.00**

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Almost 18,000 listings (including updated listings for MS, GA, SC, NC, TN, KY, WV, and VA) with over 2200 digipeaters. Band plans, CTCSS (PL™) Tone Chart, compilaton of frequency coordinators, ARRL Special Service Clubs, and beacon listins from 14 MHz to 24 GHz. **$6.00**

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Find the answer to that tricky problem. Ideas for setting up your gear for comfortable and efficient operation. **$8.00**

AR2103 • **Satellite Anthology**
The latest information on OSCARs 9 through 13 as well as the RS satellites. Information on the use of digital modes, tracking, antennas, RUDAK, microcomputer, and more! **$5.00**

AR0046 • **Satellite Experimenters Handbook**
Under one cover is what the Amateur Radio Operator needs to know in order to communicate through OSCAR satellites. **$10.00**

AR2898 • **Space Almanac**
by Anthony R. Curtis K3KYK
Extraordinary book. Captures the breathtaking recent news from space. Includes about 40 pages on Amateur Radio satellites. Find almost anything you might want to know about man's trip to the stars. 960 pages. **$20.00**

05E00 • **Solid-State Projects You Can Build**
by Rudolf F. Graf/ George J. Whalen
Have you searched for challenging innovative projects, imaginatively designed and skillfully debugged to stimulate your own creative thinking? If so, this book was written for you! **$10.50**

03R02 • **RTTY Today**
by Dave Ingram K4TWJ
The new and only up-to-date RTTY book in existence. Covers all facets of RTTY—RTTY and Home Computers—most comprehensive RTTY guide ever published. Fully illustrated. A must for RTTY fans. 112 pages. **$8.50**

02C30 • **The Commodore Ham's Companion**
by Jim Grubbs K9EI
160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! **$9.50**

03M221 • **US Military Communications (Part 1)**
Deals with US Military communication channels on shortwave. Covers frequencies, background on point to point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. 102 pages. **$12.95**

03M222 • **US Military Communications (Part 2)**
Covers US Coastguard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. 79 pages. **$12.95**

03M223 • **US Military Communications (Part 3)**
This part completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. 78 pages. **$12.95**

10A343 • **All About Cubical Quad Antennas**
by William Orr W6SAI/ Stuart Cowan W2LX
The "Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. **$9.50**

10A344 • **The Radio Amateur Antenna Handbook**
by William Orr W6SAI/ Stuart Cowan W2LX
Yagi beam theory, construction, operation. Wire beams. SWR curves. Matching systems. A "must" for serious DXers. **$11.50**

10A346 • **Simple, Low-cost Wire Antennas for Radio Amateurs**
by William Orr W6SAI/ Stuart Cowan W2LX
All New! Low-cost, multi-band antennas; inexpensive beams. "Invisible" antennas for hams in "tough" locations! New data. **$11.50**

10A342 • **All About Vertical Antennas**
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DX propagation, VHF Yagi and Quad beams, repeaters and how they work, OSCAR satellites and how to use them. **$11.95**

16A24 • **Vertical Antenna Handbook, 2nd edition**
by Paul H. Lee N6PL
A classic. Reprinted with updates, including an addendum on antenna design for 160 meters. Also, feeding and matching, short verticals, ground effects, and more.
139 pages, paperback. **$9.95**

09V11 • **The Basic Guide to VHF/UHF Ham Radio**
by Edward M. Noll
This book provides a first rate introduction to life on the 2.6 and 1.25 meter bands as well as 23, 33, and 70 CM. **$6.50**

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05E94 • **Crash Course in Electronics Technology**
by Louis E. Frenzel Jr.
With a proven format of programmed instruction, this book teaches you the basics of electricity and electronics in a step-by-step, easy-to-understand fashion. **$21.50**

01B033 • **Talk To The World: Getting Started In Amateur Radio** *by James P. Dux K3JD and Morton Keyser N3MK*
Provides information and practical tips on obtaining a novice license. Authors take the mystery out of technical and procedural aspects of ham radio. **$11.50**

09S42 • **The Scanner Listener's Handbook**
by Edward Soomre N2BFF
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by Michael Schaay
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03K205 • **Guide to Radioteletype (RTTY) Stations** *by J. Klingenfuss*
This updated famous book covers all Radioteletype Stations from 3 MHz–30 MHz. Press, Military, Commercial, Meteo, PTT's, Embassies, and more. 105 pp. **$12.95**

05P67 • **Mastering Packet Radio: The Hands-on Guide**
by Dave Ingram K4TWJ
Packet radio is the hottest, most rapidly expanding area of amateur communications. Written for the amateur enthusiast, mastering Packet Radio will put you on the cutting edge of this digital communications revolution. **$12.50**

01T01 • **Transmitter Hunting: Radio Direction Finding Simplified**
by Joseph D. Moell K0OV and Thomas N. Curlee WB6UZZ
336 pages, 248 illusts. **$17.50**

15S003 • **Communications Satellites (3rd Edtion)**
by Larry Van Horn
Includes chapters on channelization band plans, transponder identification, international satellites, and more. **$7.00**

15D90 • **1990 Shortwave Directory 6th Edition**
by Bob Grove
An excellent reference for North American shortwave listeners, this DXer's bible is crammed with up-to-date, accurate frequency and user information from 10KHz to 30KHz **$16.95**

03S04 • **The Hidden Signals on Satellite TV**
by Thomas P. Harrington and Bob Cooper Jr.
New book shows and tells how to tune in the many thousands of Telephone, Data, Telex, Teletype, Facsimile Signals on most of the TV Satellites, covers equipment, hookups, where to tune. Only book covering these secret signals on the satellites, plus all subcarriers. 234 pages. **$19.50**

06S57 • **1990 Passport to World Band Radio**
by International Broadcasting Services, Ltd.
You can have the world at your fingertips. You'll get the latest station and time grids, the 1990 Buyer's Guide and more. 384 pages. **$14.50**

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For Better QSOing

These are books that our editors feel are excellent additions to everyone's reading experience. Although they are not necessarily ham radio books, they are thought provoking and timely.

18G01 • **"Surely You're Joking, Mr. Feynman!"**
by Richard P. Feynman
Richard Feynman, who won the Nobel Prize in physics, was one of the world's greatest theoretical physicists and thrived on outrageous adventure. He traded ideas with Einstein and Bohr, discussed gambling odds with Nick the Greek, and accompanied a ballet on the bongo drums. This is Feynman's astonishing life story—a combustible mixture of high intelligence, unlimited curiosity, eternal skepticism, and raging chutzpah. **$8.95**

19M02 • **Chaos, Making a New Science** *by James Gleick*
Chaos records the birth of a new science. This new science offers a way of seeing order and pattern where formerly only the random, the erratic, the impredictable—in short, the chaotic—had been observed. After reading *Chaos*, you will never look at the world in quite the same way again. **$9.95**

20M090 • **Computing Across America**
by Steven K. Roberts N4NRVE
Steve Roberts has written articles for *73 Magazine* about the technical aspects of his US tour on his recumbent bicycle. This book covers his adventures, people he met, and places he saw. If your lifestyle seems a little confining, check this book out. **$9.95**

CODE TAPES

One answer to the no-code brou-ha-ha is to make the code so simple to learn that it's a non-problem. Herewith the world's easiest code course—tens of thousands of hams have gotten their licenses this amazing new shortcut way. It's failure-proof. Most people are able to whip through the Novice test after spending less than three hours each on Genesis and The Stickler. People who have given up on other code courses find this one does the job in a jiffy. Going after your General? It's about time. Use the Back Breaker and you'll be there before you know it. A week should do it. Warning, 20wpm code almost invariably appears to cause irreparable, irreversable, permanent brain damage. Uncle Wayne accepts no responsibility whatever for anything that happens to those who are foolish enough to use the Courageous 20wpm tape.

73T05 **"Genesis"** **$5.95**
5 wpm—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

73T13 **"Back Breaker"** **$5.95**
13+ wpm—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

73T06 **"The Stickler"** **$5.95**
6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

73T20 **"Courageous"** **$5.95**
20+ wpm—Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run: You'll wonder why the examiner is sending so slowly!

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Notes from the ELK

Bill Brown WB8ELK

Foxhunting! . . .

In this issue we highlight a really exciting part of amateur radio. This is one area where home-brew equipment is still king. Not only will you have a great time putting together your direction finding system, you'll also be able to join in the adventure of tracking down hidden transmitters. Even if you don't join in the hunt, it's fun just to gawk at the incredible variety of mobile and portable antenna arrays that show up at these events. Many countries consider foxhunting a true sporting event, complete with international competition. These foxhunts sometimes have hundreds of competitors starting out with a footrace while homing in with DF gear. You can bet the youth of these countries know that a radio can be used for something other than listening to the latest hit sounds!

One thing for sure, foxhunting is never boring. Each hunt is usually good for a few adventure stories that you're liable to hear on the local repeater for some time afterwards. Places to hide the hidden transmitter are endless and can be incredibly creative. During their last hamfest, the Indianapolis Foxhunt Club decided to hide the hidden transmitter on a mystery person who roamed the flea market. In order to find the quarry you had to wander up to perfect strangers and say, "Are you the fox?" This led to a nasty stare in most instances and came close to placing some participants in danger of a punch in the nose! Some groups go to incredible lengths to disguise the fox. During a recent Florida hunt the fox dressed up like a bag lady, complete with a shopping cart filled with old clothes and trash. The hidden transmitter was placed in the shopping cart. The bag lady fox sat on a park bench for hours having a great laugh as the hunters wandered past never once daring to ask to look in the cart! The Indianapolis group has started a new twist with an Easter Egg style hunt. They hide several low power two meter transmitters scattered around a small area, hidden in bushes and trees. Future hunts will actually use plastic eggs to house the transmitters. Wish I'd had a way to find Easter Eggs like this when I was a kid!

Our cover photo shows Eb WD9I bagging a five-point ELK (WB8ELK balloon transmitter with whip antenna). Eb showed us that you don't need a lot of fancy equipment to track down a hidden transmitter. This balloon transmitter (10 milliwatts on 2 meters) traveled 85 miles to land in a field 20 miles west of Eb's house. Beam headings from tracking stations across the Midwest narrowed the search area down to a 10-mile-square area. Using nothing more than an HT on the windshield of his car and a scanner on the front seat, Eb headed out to join in the search. After scanning the area for an hour, he heard the squelch break and the signal quickly become full-quieting. After he drove 100 yards further down the road, his scanner came to life. Jumping out of his car, he saw a small white dot in the middle of a plowed field and ran out after it. He'd found the package! Eb's now hooked on foxhunting and plans to join in the many Indianapolis hunts.

Hopefully this issue will help stir up some more foxhunting activity and show our young people that amateur radio can be really **FUN!**

Things to Come

Future issues of *73* will feature other exciting areas of amateur radio such as ATV, packet, high altitude balloons, OSCAR & weather satellites, QRP, HF operations, DXing, emergency communications, SWLing, scanning, antennas and lots and lots of construction articles. Since the demise of *Ham Radio* we intend to fill the gap with as many technical and construction articles as we can place between the covers. When possible, we'll include Radio Shack part numbers for the components in our articles. If the parts aren't available at the Shack there are several excellent mail order parts houses (Jamesco, Digi-key, Mouser and Circuit Specialists, to name a few) which should net you just about any component needed for the contruction articles published in *73*. Also, when possible, we'll let you know the source of any specialized part in the article. To save you the trouble of searching for parts we'll also be working with some of the kit manufacturers such as Ramsey and A & A Engineering to provide a complete kit for selected articles.

If you have a neat circuit or project you'd like to share with *73* readers please send it in! Please include a concise description of the circuit and its operation, a schematic diagram (can be hand-drawn as long as it's readable), parts list with manufacturer sources if possible, p.c. board layout (if used), parts placement and some photographs. If you or your club has been involved in an event that may prove interesting to *73* readers (DXpeditions, emergency communication, parades, walk-a-thons, severe weather watching, etc.), write it up, take some photos and send it in! Not only will you gain recognition and fame as a nationally published author, you'll get paid for it! If you're interested send for our "Writer's Guide."

We'll be featuring photos of radio clubs and groups across the nation in our future issues. Take a group photo and do a short write-up describing your club and when it meets. Also, if you know a ham whose efforts should gain recognition, send us a photo and some biographical info for possible use in the "Ham Profiles" section.

The *73* BBS

We've added several new special interest groups (SIGS) to the *73* phone-line BBS. Look for the ATV, Packet, Foxhunting, QRP and School SIGS. This is a *73* service available to help you keep in touch and exchange information with others of similar interests. Drop us a line if you'd like us to add any additional SIGs. You can reach the BBS via (603) 525–4438, 300 or 1200 Baud, 8 data bits, no parity, 1 stop bit.

Till next month, 73s . . . the ELK 73

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Has Cycle 22 Peaked?

At the time this forecast is being prepared, at the end of March, it appears that the sunspot maximum for Cycle 22 is either imminent or just passed. It also appears that Cycle 22 has peaked higher than any previously recorded cycle except Cycle 19, which set a record. Because of the manner in which "smoothed sunspot number" is calculated, it will be another six months or so before we can be sure that Cycle 22 has really peaked.

July will be a generally poor month for DX on weekends, sorry to say, and the generally higher atmospheric noise levels, solar absorption, and possible magnetic field disturbances on many days probably will combine to make the DX bag a poor one for the month.

However, you ought to never be discouraged by forecasts, but instead, follow the WWV broadcasts at 18 minutes after each hour to keep you up-to-date on the trends of solar flux (the higher the better) and the earth's magnetic field index (the lower the better).

On good days (second and fourth weeks of July), the HF bands will be open until after dark in the Northern Hemisphere, and very good VHF openings may present themselves on many days.

There will be a solar eclipse on July 22; it will be total for N.E. Europe, N. of Greenland, N. Asia, arctic regions, N.W. of N. America and the Hawaiian Islands. Elsewhere it will be partial.

For those who are interested, the full moon occurs on July 18, and the sun will be farthest from the Earth on July 4. The worst propagation days will probably be centered around July 2 and again around July 16.

Keep smiling—things can only improve! 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	20	20	—	—	20	20	—	—	—	—	20
ARGENTINA	15	20	20	—	—	—	—	—	—	10	10	15
AUSTRALIA	15	20	20	20	—	40	20	—	—	—	—	10
CANAL ZONE	15	20/40	20/40	20/40	—	80	10	10	10	10	10	15
ENGLAND	40	40	40	—	—	—	15	10/15	10	10/15	15/20	20
HAWAII	15	15	20	20	40	—	20	—	10(1)	10	10	10/15
INDIA	20	—	—	—	—	—	15	15	—	—	—	—
JAPAN	—	20	20	—	—	20	20	—	—	—	—	20
MEXICO	15	20/40	20/40	20/40	—	20	10	10	10	10	10	15
PHILIPPINES	—	—	20(1)	—	—	20	15(1)	10(1)	—	—	—	15(1)
PUERTO RICO	15	20/40	20/40	20/40	—	20	10	10	10	10	10	15
SOUTH AFRICA	20	—	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	—	—	20	20	20	—	—	15	15	—	20	20
WEST COAST	20	20/40	20/40	40	40	40	10	10	10	10	10	15

CENTRAL UNITED STATES TO:

ALASKA	10(1)	20	20	20	—	—	20	—	—	—	15	10/15
ARGENTINA	15	15	20	20	—	—	—	10	—	10	10	10
AUSTRALIA	10	15	20	20	20	20/40	20	20	—	15(1)	10	10
CANAL ZONE	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	—	15	10(1)	15	20	20
HAWAII	10/15	15	20	20/40	20/40	20	—	—	—	10	10	10
INDIA	15(1)	20(1)	—	—	—	—	20(1)	15(1)	—	—	—	—
JAPAN	10(1)	20	20	20	—	—	20	—	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
PHILIPPINES	10(1)	—	20(1)	—	—	—	20(1)	15	15	—	—	10(1)
PUERTO RICO	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
SOUTH AFRICA	—	—	20	—	—	—	—	—	10	10	15	20
U.S.S.R.	—	—	20(1)	—	—	—	—	15(1)	15(1)	20	20	20

WESTERN UNITED STATES TO:

ALASKA	10	10/15	—	20	20	20	20(1)	20	—	—	—	10/15
ARGENTINA	10	15	20	20	20	—	—	—	—	10	—	10
AUSTRALIA	10	10	15	20	20	20/40	40	20	20	—	10	10
CANAL ZONE	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	15	20	20
HAWAII	10	15	15	20	20/40	40	40	—	15	15	—	10
INDIA	15(1)	15(1)	20(1)	—	—	—	—	20(1)	15(1)	—	—	—
JAPAN	10	10/15	—	20	20	20	20(1)	20	—	—	—	10/15
MEXICO	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
PHILIPPINES	15	—	—	20	20	20	20	20	20	20	20	15
PUERTO RICO	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
SOUTH AFRICA	20	20	20	20	—	—	—	—	10	10	15	20
U.S.S.R.	—	—	—	20(1)	20(1)	—	—	20(1)	15(1)	15(1)	20	20
EAST COAST	20	20/40	20/40	40	40	40	10	10	10	10	10	15

Note: (1) Possible on some days.
Use 10 for 10 & 12 meter bands; use 15 for 15 & 17 meter bands; use 40 for 30 & 40 meter bands. Where 2 bands are shown, try both. This data is for the highest possible frequency to be used of a given path. (MUF)

JULY 1990

SUN	MON	TUE	WED	THU	FRI	SAT
1 P	2 P-F	3 P-F	4 P-F	5 P-F	6 P-F	7 P-F
8 F-G	9 G	10 G	11 G	12 G	13 G-F	14 F-P
15 P	16 P	17 P-F	18 F	19 G	20 G	21 G
22 G	23 G	24 G-F	25 F	26 F	27 F	28 F
29 F	30 F-G	31 G				

Performance.

Performance. Yours and your radio's. They go hand in hand. To be a truly world-class competitor, you've got to have a truly world-class rig. And it's here, now. The versatile new FT-1000 from Yaesu.

The FT-1000 will blow away your competition with a spectacular combination of power and operating flexibility with such features and options as:

• **Direct Digital Synthesis (DDS),** two ten-bit DDS plus three eight-bit DDS for fast lock-up time and lower synthesizer noise than other traditional PLL systems.

• **High RF Power Output,** continuous adjustable output from 20 to a full 200 watts.

• **Dual Receive** utilizing two tuning knobs for easy spotting; with optional BPF-1 module allows cross-band dual receive.

• **Digital Voice Storage (DVS-2)** option provides instant playback of 16-second receive memory, plus two 8-second "CQ Contest" messages on transmit.

• **Automatic Antenna Tuner** built-in with fast action and 39 memories for quick band changes.

• **QRM Rejection Systems,** including a variety of cascaded filter selections, width control, IF shift, IF notch filter, all-mode squelch, dual-mode noise blanker and a CW audio peaking filter.

Additional Features: 108dB dynamic range • front panel RX antenna selector • built-in electronic keyer module • stereo dual receive • flywheel effect on main and sub VFO tuning dials • twin frequency displays • CW spot.

A product of three years of intensive research and design. This HF rig will allow you to achieve a position of competitive dominance.

See the exciting new FT-1000 at your Yaesu dealer today. It's the best of the best.

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The Ultimate Signal.

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

• **Dual Frequency Receive Function.** The TS-950SD can receive two frequencies simultaneously.

• **New! Digital AF filter.** Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.

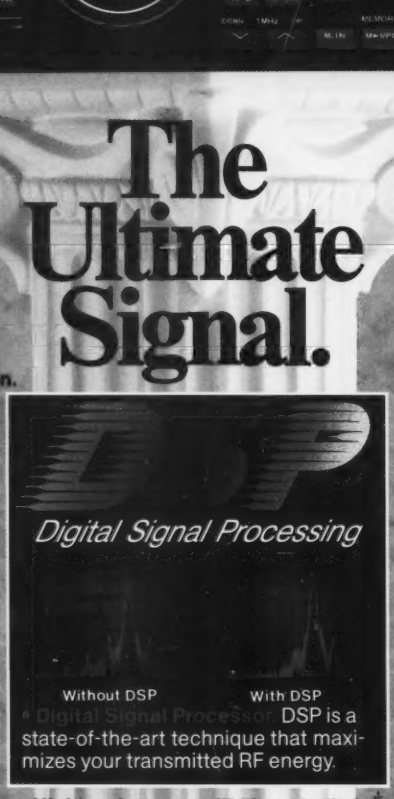
• **New high voltage final amplifier.** 50 V power transistors in the 150-watt final section, resulting in minimum distortion and higher efficiency. Full-power key-down time exceeds one hour.

• **New! Built-in microprocessor controlled automatic antenna tuner.**

• **Outstanding general coverage receiver performance and sensitivity.** Kenwood's Dyna-Mix™ high sensitivity direct mixing system provides incredible performance from 100 kHz to 30 MHz. The Intermodulation dynamic range is 105 dB.

• **Famous Kenwood interference reduction circuits.** SSB Slope Tuning, CW VBT (Variable Bandwidth Tuning), CW AF tune, IF notch filter, dual-mode noise blanker with level control, 4-step RF attenuator (10, 20, or 30 dB), switchable AGC circuit, and all-mode squelch.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features and prices subject to change without notice or obligation.



• **Digital Signal Processor.** DSP is a state-of-the-art technique that maximizes your transmitted RF energy.

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• ***Multi-Drive Band Pass Filter*** **(BPF) circuitry.** Fifteen band pass filters are available in the front end to enhance performance.

• **Built-in TCXO for the highest stability.†**

• **Built-in electronic keyer circuit.**

• **100 memory channels.** Store independent transmit and receive frequencies, mode, filter data, auto-tuner data and CTCSS frequency.

• **Digital bar meter.**

Additional Features: • Built-in interface for computer control • Programmable tone encoder • Built-in heavy duty AC power supply and speaker •Adjustable VFO tuning torque • Multiple scanning functions • MC-43S hand microphone supplied

Optional Accessories

• DSP-10 Digital Signal Processor* • SO-2 TCXO* • VS-2 Voice synthesizer • YK-88C-1 500 Hz CW filter for 8.83 MHz IF* • YG-455C-1 500 Hz CW filter for 455 kHz IF* • YK-88CN-1 270 Hz CW filter for 8.83 MHz IF • YG-455CN-1 250 Hz CW filter for 455 kHz IF* • YK-88SN-1 1.8 kHz SSB filter for 8.83 MHz IF • YG-455S-1 2.4 kHz SSB filter for 455 kHz IF* • SP-950 External speaker w/AF filter • SM-230 Station monitor w/pan display • SW-2100 SWR/power meter • TL-922A Linear amplifier (not for QSK)

* Built-in for the TS-950SD
† Optional for the TS-950S

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KENWOOD ELECTRONICS CANADA INC.
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